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JPRS 68142

1 November 1976

U S S R

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

MATERIALS SCIENCE AND METALLURGY

No. 40

EAST
EUROPE



20000317 126

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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 68142	2.	3. Recipient's Accession No.
4. Title and Subtitle USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - MATERIALS SCIENCE AND METALLURGY, No. 40		5. Report Date 1 November 1976	
7. Author(s)		6.	
9. Performing Organization Name and Address Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201		8. Performing Organization Rept. No.	
		10. Project/Task/Work Unit No.	
		11. Contract/Grant No.	
12. Sponsoring Organization Name and Address As above		13. Type of Report & Period Covered	
		14.	
15. Supplementary Notes			
16. Abstracts The report contains abstracts on metals, alloys and superalloys, analysis and testing of metals and materials, coatings, composites, metal corrosion, extraction and refining, forming, instrumentation, lubricants, mechanical and physical properties of metals, powder metallurgy, textiles, welding practice, glass and ceramics, heat treatment, nuclear science and technology, semiconductor technology, thermomechanical treatment, and related fields.			
17. Key Words and Document Analysis. 17a. Descriptors USSR Eastern Europe Metallurgy Welding Corrosion Crystallography Solid State Physics Lubricants			
17b. Identifiers/Open-Ended Terms			
17c. COSATI Field/Group 11B, 11F, 11H, 13H, 20B, 20L			
18. Availability Statement Unlimited Availability Sold by NTIS Springfield, Virginia 22151		19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 78
		20. Security Class (This Page) UNCLASSIFIED	22. Price 4.50

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS
MATERIALS SCIENCE AND METALLURGY

No. 40

This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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USSR

UDC 546.1:788.33

GINZBURG, S. S., and KRAVCHENKO, V. YE., Krasnoyarsk Institute of Nonferrous Metals imeni Kalinin

METHODOLOGICAL FEATURES OF THE AUTORADIOGRAPHIC STUDY OF HYDROGEN DISTRIBUTION IN METALLIC MATERIALS

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 42, No 7, 1976 pp 809-811

[Abstract] Since the determination of hydrogen (tritium) distribution in metals is an important problem with respect to metal brittleness, certain steps must be followed in the preparation of specimens for autoradiographic study. The peculiar behavior of tritium requires the activation of specimens either by (a) electrolysis in acidified tritium water; (b) electrolysis in tritium water followed by annealing; (c) interaction of specimens with tritium vapors at high temperature; or (d) thermodiffusion of tritium vapors into specimens. The best activation method is the thermodiffusion of tritium vapors into specimens from a gaseous phase at 700-800°C for steel and nickel alloys, and at 300-500°C for aluminum alloys. In 1-3 hours a complete saturation of specimens with tritium is possible. Prior to activation, microsections must be prepared on the surface of specimens by electropolishing which removed 50-100 μm of the surface metal. This prevents the

1/2

USSR

GINZBURG, S. S., and KRAVCHENKO, V. YE., ZAVODSKAYA LABORATORIYA Vol 42, No 7, 1976 pp 809-811

recrystallization of specimens during the activation stage. Since tritium produces a good image only in a very thin (about 0.2 μm) emulsion layer, care should be taken to put the emulsion layer directly on the metal surface, without trapping any air between the emulsion layer and the metal. Using a single layer of emulsion crystals on top of the carbon replica deposited on specimens (electron microscope autoradiography) makes it possible to obtain a resolution of about 0.2 μm , as compared with 10-20 μm for contact autoradiography. Interaction of specimens with emulsion can be eliminated by lowering the study temperature to -20°C and by performing tests in vacuum. However, this decreases the method's sensitivity. Figures 1; references 6: 2 Russian and 4 Western.

USSR

UDC 543.062:539.211

BERNSHTEYN, M. L. et al

DEVELOPMENT AND EXPERIMENTAL CHECKING OF A METHOD FOR QUANTITATIVE ANALYSIS OF THE RASTER IMAGES OF STEEL FRACTURES

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 50-54

[Translated from Author Abstracts provided in the Journal]

[Text] A method is described for quantitative analysis of the structure of viscous and brittle fractures in steel according to their raster images by the method of optical-structural machine analysis. A number of statistical distinguishing characteristics are found (dispersion, asymmetry, excess, correlation interval), which can be used for quantitative evaluation of fractures during machine processing of fractographic images by computer. A digital matrix is produced, reflecting the actual structure of the rupture surface and allowing calculation of the geometric parameters of the characteristic structural elements.

1/1

USSR

UDC 669.725:620.172.224.2

KHRISTENKO, I. N., PAPIROV, I. I., TIKHINSKIY, G. F., Physico Technical Institute, Acad. Sci. UkrSSR

INFLUENCE OF STRUCTURAL FACTORS ON THE CREEP LIMIT OF BERYLLIUM

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 7, 1976 pp 30-32

[Abstract] A study is made of the influence of the degree of perfection of the texture, content of impurities and test conditions on the coefficients of the Hall-Patch equation. The coefficients of the Hall-Patch equation are determined by the relative fraction of resistance to base and prismatic slipping in the direction of flow of the polycrystalline beryllium. As the test temperature increases, the value of σ_i changes similarly to the yield point; the coefficient K_y changes little up to 500°K, then decreases over 500°K. An increase in impurity content increases σ_i but has almost no influence on K_y .

1/1

USSR

UDC 621.762.4

KARPINOS, D. M., PILIPOVSKIY, YU. L., DOBROVOL'SKIY, A. N., GROSHEVA, V. M.,
and ANDRIYEVSKAYA, G. P.

INVESTIGATION OF HOT PRESSING OF A REFRACTORY CERAMIC REINFORCED WITH
FILIMENTARY CRYSTALS

Kiev GORYACHEYE PRESSOVANIYE, VYP 2 [Hot Pressing, No 2, Collection of Works]
in Russian 1975 pp 139-143

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 7, 1976 Abstract No 7G751 by
T. Kozlovskaya]

[Text] The authors generalize the results of an investigation on composite materials based on MgO , ZrO_2 , Si_3N_4 and BN , reinforced with filamentary crystals of $\alpha-Al_2O_3$. The materials were produced by the method of hot pressing. The filamentary crystals were introduced in an amount of 5-15 vol %. Reinforcement with Al oxide is an effective means of increasing the heat resistance. Tables 2; references 7.

1/1

USSR

UDC 539.4

GUNYAYEV, G. M., KOBETS, L. P., ZAYTSEV, G. G., All-Union Institute of
Aviation Materials

DETERMINATION OF THE MEAN VALUES OF MECHANICAL PROPERTIES OF CARBON FIBERS
FROM THE RESULTS OF TESTING OF CARBON-REINFORCED PLASTICS

Kiev PROBLEMY PROCHNOSTI in Russian No 8, 1976 pp 36-40 manuscript received
7 Jan 75

[Abstract] Since the cross-section area of carbon fibers may vary by as much as 30%, strength testing of individual fibers must be repeated many times (typically 100 or more) in order to achieve satisfactory accuracy of results. It is simpler to test a braid or cord of fibers twisted together and held with a plastic binder, allowing the testing of many fibers simultaneously. This requires simply that the properties of the binder be taken into consideration mathematically in judging the test results. It is shown that comparison of the values of strength and Young's modulus produced by testing of single fibers and of polymer-bound bundles can be undertaken over a base corresponding to the effective length of the fiber. Experimentally tested equations are presented considering the reduction in properties of the fiber due to

1/2

USSR

GUNYAYEV, G. M., KOBETS, L. P., ZAYTSEV, G. G., PROBLEMY PROCHNOSTI No 8, 1976 pp 36-40

the influence of dispersion curvature of fibers and variation of the system from monolithic. These equations can be used for analysis and prediction of the properties of composite materials.

2/2

USSR

UDC 621.762

KOLESNICHENKO, L. F., NAZARENKO, N. D., YUGA, A. I., VLASKO, N. I., IVASHOV, F. D., SUKHIKH, L. L., SEDLYAR, G. A., Institute of Problems of Material Science, Acad. Sci. UkrSSR

WORKING OF COMPOSITE MATERIALS BASED ON SITALL

Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, 1976 pp 98-99 manuscript received 7 Jan 76

[Abstract] The high mechanical strength and wear resistance of glass ceramics (sitalls) allows them to be used for friction bearings operating under high load and temperature, in corrosive media, etc. The introduction of metallic fillers significantly increases the friction characteristics and expands the area of application of these composite materials. One characteristic feature of materials based on sitalls with metallic fillers is their low workability, due to their high hardness and cracking tendency. The authors feel that the most acceptable and efficient method of working of this type of composite material is grinding. Studies have shown that grinding of sitall with abrasive tools is nonproductive due to the significant heat liberation, difficulty of carrying heat away from the grinding zone and high hardness of the material worked. Diamond working significantly improves productivity and finish. Optimal modes are selected for working of composite materials and diamond tools are selected allowing maximum productivity of the process.

1/1

USSR

UDC 669.2:621.74

KUZ'MIN, L. I., KOEMETS, N. A., and BELYAYEVA, N. A.

REFRACTORY PARTS MADE FROM COMPOSITE MATERIAL

Moscow TSVETNYYE METALLY in Russian No 5, May 76 p 54

[Abstract] Continuous casting combined with rolling of wire and strips of nonferrous metals has required development of new refractory materials with a specific combination of properties to ensure reliable operation of equipment: low heat conduction, fairly high mechanical strength at ordinary and high temperatures (up to 1450°C), good thermal stability, erosion resistance and the necessary chemical stability.

The Eastern Institute of Refractories has developed new composite refractory items that meet these requirements. They have tested out successfully and have been introduced in a number of plants as metal chutes and batchers for pouring nonferrous metals. Fundamental properties of the items: mechanical compression strength 160-350 kgf/cm², porosity 22-42%, heat resistance 1370-1750°C, coefficient of thermal conductivity 0.02-0.5 kcal/(m·hr·deg).

The technique can be used to make items with wall thickness up to 2-3 mm in simple and complex shapes.

1/1

USSR

UDC 621.921

PYATKIN, A. A., BONDARENKO, E. A., GREBENKINA, V. G., SOKOLOV, B. P.,
Institute of Problems of Material Science, Acad. Sci. UkSSR

THERMALLY STABLE COMPOSITE MATERIALS BASED ON THE BORIDES OF REFRACTORY METALS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, 1976 pp 51-55 manuscript received 6 Apr 75

[Abstract] Domestically produced position resistors such as types TVO, SPO, etc. have a significant thermal coefficient of resistivity (TCR) (-20 - +6) · 10⁻⁴ deg⁻¹, limiting their use. Therefore, the authors attempted to create composite materials with low absolute values of TCR. The resistive composition used is a multiphase heterogeneous system consisting of a current-conducting phase, a glass binder and a filler. In order to produce the minimum TCR of the resistive layer, one must take as a guide the area of concentration of the current-conducting components of the composition in which the sign of TCR switches to the opposite. Semiconductors and metallic compounds with similar values of resistivity can be used to facilitate the search for this area. The TCR of the composite systems, considering the limitations, will always be less than the TCR of the metal conducting

1/2

USSR

PYATKIN, A. A., BONDARENKO, E. A., GREBENKINA, V. G., SOKOLOV, B. P.,
POROSHKOVAYA METALLURGIYA No 8, 1976 pp 51-55

component or the TCR of the contact junction (gap); this drop in absolute value of equivalent TCR of the system results from the effect of mutual compensation of the TCR of the metallic and semiconductor components and the TCR of the gap due to the opposite nature of the change of the conductivities with changing temperature.

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USSR

UDC 678.067.5

KANOVICH, M. Z., KOLTUNOV, M. A., and ROGINSKIY, S. L., All-Union Scientific Research Institute of Glass Plastics and Glass Fibers, Moscow, and the Moscow Institute of Electronic Machinery

AN INVESTIGATION OF THE DENSITY OF FIBER PACKING IN A UNIDIRECTIONAL COMPOSITE

Riga MEKHANIKA POLIMEROV in Russian No 3, May-Jun 76 pp 538-541 manuscript received 27 Mar 75

[Abstract] Microstructural analysis of unidirectional fiberglass sheets of regular structure indicates that the thickness of the polymer layer is minimal in comparison with the fibers' diameters, so that most of the binder does not fulfill its primary function of bringing indirectly burdened elements into the work of the composite. Thus, that nonperforming part of the binder is mere ballast. It can be shown that when fibers of varying diameters are used, even with increased distance between elements, the content of pure filler remains high. This occurs since the spaces between the primary fibers become filled with smaller-diameter materials as the ballast portion of the binder is decreased. In actual composites, in contrast to ideal laboratory groupings, the fiber diameters are random. Calculations demonstrate that in cases of balanced, normal and exponential laws of distribution, the

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USSR

KANOVICH, M. Z., KOLTUNOV, M. A., and ROGINSKIY, S. L., MEKHANIKA POLIMEROV
No 3, May-Jun 76 pp 538-541

density of fiber-binder borders is determined by the average diameters of the armature and its relative content of fibers and binder. In cases of Weibull distribution and a logarithmic norm, the density of boundaries is further dependent on distribution parameters. Figures 2; references 7: 6 Russian, 1 German.

2/2

USSR

UDC 669.71:620.18

SHORSHOROV, M. KH., SAVVATEYEVA, S. M., SYRKIN, V. G., UEL'SKIY, A. A. and SHEBATINOV, M. P., Moscow

ELECTRON MICROSCOPE STUDY OF CARBONYL METAL COATINGS FOR CARBON FIBERS AS REINFORCEMENT FOR COMPOSITE MATERIALS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 141-143 manuscript received 24 Jun 75

[Abstract] The paper gives the results of electron microscope studies of the structure and quality of coatings made under different conditions from carbides of tungsten, molybdenum and nickel. This is the first time that the carbonyl method has been used for applying refractory metal coatings to carbon fiber. It is shown that structurally different coatings can be produced, depending on the temperature to which the backing is heated, the nature of the backing and the carbonyl feed rate. Porous molybdenum, tungsten and nickel coatings are produced with a well developed dispersed surface, ensuring conditions for the capillary effect of wetting with liquid metal melts. References 4 Russian.

1/1

PETRENKO, V. T., POLYAKOV, L. M., RUDYCHEVA, T. YU., SOMOV, A. I. and
CHERNYY, O. V., Khar'kov

HYDRAULIC EXTRUSION OF EUTECTIC Al-Al₃Ni COMPOSITE

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 118-122 manuscript received 12 Nov 75

[Abstract] Hydraulic extrusion of Al-Al₃Ni eutectic fiber composite material was studied in the temperature range of 20-300°C. The extrusion press produced pressures of up to 10⁴ kgf/cm², which was transmitted to the workpiece by silicone oil. The workpiece and fluid were heated by a resistance furnace with nichrome element wound around the extrusion container. An investigation was made of the influence of different extrusion conditions on microstructure and mechanical properties. It was found that the extrusion pressure plotted against the degree of stretching gives a straight line in semilogarithmic coordinates. Extrusion pressure increases with increasing dispersity of the eutectic components. The change in shape of the material during extrusion is due both to shear and to complex rotations of macroscopic regions. Shear can occur even lengthwise of the reinforcing fibers. Deformation of the composite material becomes more

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USSR

PETRENKO, V. T., POLYAKOV, L. M., RUDYCHEVA, T. YU., SOMOV, A. I. and
CHERNYY, O. V., FIZIKA I KHIMIYA OBRABOTKI MATERIALOV, No 4, Jul/Aug 76,
pp 118-122

uniform with increasing temperature. A method is proposed for determining the degree of stretching at which the reinforcing fibers reach a predetermined ratio of length to diameter. References 6: 4 Russian, 2 Western.

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USSR

UDC 678.067.5:539.319

MURZAKHANOV, G. KH., and TIKHONOV, V. A., Moscow Power Institute

CALCULATING CONTRACTION TENSION IN FIBROUS COMPOSITES OF REGULAR STRUCTURE

Riga MEKHANIKA POLIMEROV in Russian No 3, May-Jun 76 pp 409-415 manuscript received 12 Jul 74

[Abstract] A study was made of the formation of microscopic residual tensions in a composite at all stages of heat treatment. The composite was in the form of a polymer binder (matrix) and elastic fibers of circular cross-section. The fiber materials had elastic symmetry axes that coincided with the geometric axes, and greatly differing coefficients of heat expansion both in the plane of the axis and transversely. The polymer binder was an isotropic, linear, viscoelastic material, whose properties changed in the heat treatment cycle. Durability and heat characteristics of the fibers were considered to be stable throughout the process. The thermoelastic solution obtained can be utilized for calculating residual microscopic tensions on the analogy of the hypoviscous durability approach, which is a function of structural parameters and temperature. Calculations indicated that chemical contraction of the binder contributes insignificantly to residual tensions in comparison to thermal contractions. The crucial impact of the speed of cooling on the magnitude of residual tensions was also demonstrated. Figures 6; formulas 8; references 12: 11 Russian, 1 English. 1/1

USSR

UDC 621.762.4+621.763+669.71

KARPINOS, D. M., BERESNEV, B. I., KADYROV, V. KH., KAMENETSKIY, A. G.,
Institute of Problems of Material Science, Acad. Sci. UkSSR

HYDROSTATIC PRESSING OF COMPOSITES BASED ON POWDERED ALUMINUM

Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, 1976 pp 14-15 manuscript received 17 Oct 74

[Abstract] A study is made of the influence of the type and volumetric content of reinforcing fibers on the pressing properties of aluminum powder using the hydrostatic method. The reinforcing components were discrete fibers and "lastik" woven screen of high-strength type Kh18N10T steel. The presence of the steel fibers increases the elastic aftereffect, and the pressability of the aluminum powder deteriorates with increasing fiber content. Thus, during hydrostatic pressing of composites based on Al fiber, the deformation resistance can be characterized by two constants: P_{\max} and $m[P/P_{\max} = \theta^m]$, θ is the relative density of the pressings, m varies from 7.0 to 7.9].

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Conferences

USSR

UDC 621.791:061.3

ZIL'BAN, M.

ALL-UNION CONFERENCE ON ARC WELDING

Kiev AVTOMATICHESKAYA SVARKA in Russian No. 8, 1976 pp 77-78

[Abstract] The All-Union Conference on Arc Welding was held in Kiev 11-12 May. Over 500 specialists representing 194 organizations from some 80 cities of the country attended. Subjects discussed at the conference included the current state of welding in the world, emphasizing that the electric arc will remain for some time the main means for joining of metals and nonmetals throughout the world; means for saving of metal in welded structures; the use of high-strength steels to save metal; the prospects for the production of progressive structural steels and various rolled products for welded structures; optimization of welded joints in metal structures; hygiene and protection of labor during arc welding; the development of plasma and microplasma welding; the physical peculiarities of low-ampere arcs; the development of pulsed arc welding with fusible electrodes; increasing the productivity of arc welding; welding with powder wire; welding in mixtures of protective gases; self-protective powder wire and strip; and the development and introduction of welding robots.

1/1

USSR

UDC 620.193.27

ALIYEV, A. F., and FREYMAN, L. I., Baku Affiliate of the All-Union Scientific Research Institute of Water Supply, Sewer Systems, Hydraulic Engineering Structures and Hydrogeological Engineering, and the Scientific Research Institute of Physical Chemistry imeni L. Ya. Karpov

INVESTIGATION OF THE ELECTROCHEMICAL BEHAVIOR OF ALUMINUM ALLOYS WITH APPLICATION TO CONDITIONS OF OPERATION OF INSTALLATIONS FOR THERMAL DESALINATION OF CASPIAN SEA WATER

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 387-392
manuscript received 22 Aug 75

[Abstract] An investigation is made of the corrosion behavior of Soviet aluminum alloys as prospective construction materials for thermal desalination units on the Caspian Sea. It is found that a number of industrial aluminum alloys retain their passive state in Caspian Sea Water over ranges of variation in temperature, degree of evaporation, water flowrate and heat transfer that correspond to the conditions of operation of thermal desalination units. Prevention of scale formation by acidifying the water presents no corrosion hazard if the pH does not fall below 6.0-6.5, and if scale formation is controlled by adding phosphate or antiscaling surfactants, the

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USSR

ALIYEV, A. F., and FREYMAN, L. I., ZASHCHITA METALLOV, Vol 12, No 4, Jul/Aug 76 pp 387-392

resistance to corrosion is improved. The electrochemical data of the research are confirmed by laboratory and industrial tests. The results show that AMts, AMtsM, AV, AMg3M and AD1 aluminum alloys can be recommended as construction materials for thermal desalination of Caspian Sea water. It is suggested that anionic surfactants be used as scale inhibitors and corrosion preventives. References 22: 11 Russian, 11 Western.

2/2

GERNETS, L. V., TOMILIN, I. A., GOLOVANENKO, S. A. and SVISTUNOVA, T. V.,
Central Scientific Research Institute of Ferrous Metallurgy imeni I. P.
Bardin.

THERMODYNAMIC ANALYSIS OF PROCESSES OF CARBIDE FORMATION AND INTERCRYSTALLINE
CORROSION IN ALLOYS OF THE NICKEL-MOLYBDENUM SYSTEM

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 381-386
manuscript received 5 Feb 75

[Abstract] A thermodynamic calculation is done on molybdenum depletion of the boundary sections of grains in nickel molybdenum alloys. The calculated depth of corrosion penetration agrees satisfactorily with the experimental value. This shows that molybdenum depletion of the boundary zones as a consequence of carbide segregation is responsible for inclination to intercrystalline corrosion, which can be predicted by the proposed method. The inclination of alloys to intercrystalline corrosion at quenching temperatures T_q below the temperature of total carbide solubility T_s can be reduced only by increasing the molybdenum content. When $T_q > T_s$, the tendency to intercrystalline corrosion can be reduced only by reducing the carbon content in the alloy. In the region $T_q > T_s$ a change in quenching temperature does not

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GERNETS, L. V., TOMILIN, I. A., GOLOVANENKO, S. A. and SVISTUNOVA, T. V.,
ZASHCHITA METALLOV, Vol 12, No 4, Jul/Aug 76 pp 381-386

influence the temperature interval of inclination to intercrystalline corrosion. In the region $T_q < T_s$ a reduction in quenching temperature narrows the temperature range of inclination of the alloys to intercrystalline corrosion. References 13: 9 Russian, 4 Western.

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BOGOLYUBSKIY, S. D., GOLOVANENKO, S. A., TOMILIN, I. A. and UL'YANIN, YE. A.,
Central Scientific Research Institute of Ferrous Metallurgy imeni I. P.
Bardin

THERMODYNAMIC ANALYSIS OF THE INFLUENCE OF CHROMIUM AND CARBON ON INTER-
CRYSTALLINE CORROSION OF STEELS WITH 20% NICKEL

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 373-380
manuscript received 10 Nov 74

[Abstract] The influence of chromium and carbon on the maximum temperature T_{\max} of occurrence of intercrystalline corrosion and the minimum time to occurrence of corrosion τ_{\min} is quantitatively described on the basis of thermodynamic relations. The calculations are experimentally confirmed. It was found that in steels with constant chromium or carbon content there is an increase in τ_{\min} with a reduction in T_{\max} , the parameter τ_{\min} being more sensitive to steel composition. For instance in Kh24N20 steel with an increase in carbon content from 0.018 to 0.045% τ_{\min} changes from 1800 to 20 minutes, while T_{\max} changes from 635 to 670°C. With 0.025% C, an increase in chromium concentration from 14 to 24% leads to a change in τ_{\min} from 20 to 240 minutes, and in T_{\max} from 710 to 640°C. It is concluded that

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USSR

BOGOLYUBSKIY, S. D., GOLOVANENKO, S. A., TOMILIN, I. A. and UL'YANIN, YE. A.,
ZASHCHITA METALLOV, Vol 12, No 4, Jul/Aug 76 pp 373-380

a change in carbon content by -0.002% is equivalent to a change in chromium content by +1%. As the carbon concentration decreases, the influence of chromium on the inclination to intercrystalline corrosion in austenite steels decreases, becoming insignificant at carbon concentrations $\leq 0.01\%$.
References 17: 13 Russian, 4 Western.

2/2

TRUSOV, G. N. and GOCHALIYEVA, YE. P., Scientific Research Institute of Physical Chemistry imeni L. Ya. Karpov

CATHODIC BEHAVIOR OF TITANIUM AND ITS ALLOYS

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 445-447
manuscript received 8 Jan 75

[Abstract] An investigation is made of the cathodic behavior in sulfuric acid and potassium hydroxide of titanium and its alloys with β -structure, including those with surface modified by noble metals (palladium and platinum). It was found that the rate of hydrogenation is determined by the potential rather than by the current, and that hydrogenation of the platinum-modified titanium takes place with the participation of platinum, as etching of the surface slows down the reaction of recombination of the hydrogen atoms from the surface with a corresponding increase in activity and in the rate of penetration into the titanium. References 11 Russian.

1/1

ULANOVSKIY, I. B., YEGOROVA, V. A. and LUKASHEVA, T. A., Academy of Sciences USSR, Institute of Oceanology, Southern Department

CORROSION OF STEELS, TITANIUM AND COPPER AT DIFFERENT DEPTHS IN THE BLACK SEA

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 439-441
manuscript received 4 Dec 74

[Abstract] Corrosion tests were conducted in the vicinity of Gelendzhik, five nautical miles from shore. A frame holding the specimens was fastened to a stabilized buoy at depths of 7, 27, 42 and 80 m. The materials tested were Kh18N9T stainless steel, St.3 carbon steel, VT-4 titanium alloy and M-1 copper. The specimens were placed in July 1972 and removed in April 1974. Tables are given summarizing data on the total weight of biomass overgrowth and number of barnacles, rate of corrosion as a function of depth, and the hydrochemical characteristics of the test area (averaged over the test period). The data are interpreted separately for each type of metal. References 9: 8 Russian, 1 Western.

1/1

KORNILOV, I. I., SHREYBER, G. K. (deceased), BRYSKIN, A. M., BORISKINA, N. G. and KENINA, YE. M., Academy of Sciences USSR, Institute of Metallurgy, Moscow Institute of the Petrochemical and Gas Industry imeni I. M. Gubkin

INVESTIGATION OF THE CORROSION AND ELECTROCHEMICAL BEHAVIOR OF AT-3 AND AT-6 TITANIUM ALLOYS FOR DEEP-DRILLING PIPES

Moscow ZASHCHITA METALLOV in Russian Vol 12, No 4, Jul/Aug 76 pp 408-410
manuscript received 12 Sep 74

[Abstract] An investigation is made of the corrosion-electrochemical behavior of AT-3 and AT-6 titanium alloys developed at the Institute of Metallurgy imeni A. A. Baykov to determine their suitability for deep-drilling pipes. The alloys do not contain scarce or expensive dopants, and have the structure of an α -solid solution with small amounts of β -phase. It is found that the reduction in mechanical properties and the rate of corrosion is about the same for both alloys. Regression analysis of the test results shows little change in ultimate strength or relative longitudinal extension, and a low corrosion rate. References 6 Russian.

Heat Treatment

USSR

UDC 621.785.363:669.14.018.263

BRUNZEL', YU. M., POTEKIN, K. D., RYBAKOV, P. P. and MOISEYEV, B. A., Central Scientific Research Institute of Ferrous Metallurgy

INFLUENCE OF HEAT-TREAT CONDITIONS ON THE DUCTILITY OF STEELS FOR COLD UPSETTING

Moscow STAL' in Russian No 8, Aug 76 pp 750-754

[Abstract] An analysis is made at the Central Scientific Research Institute of Ferrous Metallurgy on the influence that kinds of heat treatment and time-temperature schedules have on the mechanical properties of grades 45, 35Kh, 30KhGSA and 38KhGNMA steel. It is found that the optimum heat treatment that maximizes requirements of new standards is isothermal annealing (750-780°C, 0.5 hr, 680-710°C, holding for at least 3 hr). High-temperature tempering (680-710°C) of considerable duration (at least 10 hr) guarantees a high degree of upsetting (83-85%), but 35Kh and 35KhGSA steels do not reach the required hardness. Tempering maximizes upsetting for grades 45, 35Kh and 38KhGNMA, but with increased hardness. Cold working of isothermally annealed rolled 38KhGNMA steel during drawing (calibration) and also with subsequent recrystallization annealing does not reduce the degree of cold upsetting of specimens. Surface defects appreciably reduce critical

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USSR

BRUNZEL', YU. M., POTEKIN, K. D., RYBAKOV, P. P. and MOISEYEV, B. A., STAL', No 8, Aug 76 pp 750-754

upsetting; for instance critical upsetting for 38KhGNMA steel is reduced by 18% under the effect of surface cracks. Continuous zone furnaces are recommended for optimum heat treatment of steels for cold upsetting. References 4: 3 Russian, 1 Western.

2/2

USSR

UDC 669.295.5'71'26'28:[620.17+548.7

TOMSINSKIY, V. S., SHISHKINA, M. I. and POLOVNIKOV, V. M.

INFLUENCE OF HEAT AND THERMOMECHANICAL TREATMENT ON THE STRUCTURE AND PROPERTIES OF THE VTZ-1 TITANIUM ALLOY

Izhvesk POVYSHENIYE PROCHNOSTI I DOLGOVECHN DETALEY MASHIN [Increasing the Strength and Lifetime of Machine Parts, Collection of Works] in Russian, No 2, 1975 pp 29-38

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 7 1976 Abstract No 7I694 by V. Bochkareva]

[Text] The authors investigated the possibilities of correcting the coarse-grain structure of a preliminarily overheated Ti alloy VTZ-1 by various methods of heat and thermomechanical treatment to increase the group of its mechanical properties. The best version of the alloy treatment mode is 50% deformation at temperatures of the upper interval of the ($\alpha + \beta$) region with quenching in water and subsequent aging. As a result of this treatment it is possible to produce $\sigma_B = 146 \text{ kg/mm}^2$ with $\delta = 9\%$ and $\psi = 35\%$. The structure of the VTZ-1 alloy after high-temperature mechanical treatment is more uniform than after ordinary quenching. During aging the metastable phases decay with the formation of highly disperse determinations of the secondary α and β phases. Figures 4; tables 3; references 5.
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USSR

UDC 620.178.38:620.197

ISHCHENKO, I. I., OMEL'CHENKO, V. I., SINAYSKIY, B. N., POGREBNIYAK, A. D., BANAS, P. S., REZNIK, M. I., Zaporozh'ye "Motorostroitel'" Production Union, Institute of Mechanics, Acad. Sci. UkSSR

STUDY OF THE INFLUENCE OF STANDARD HEAT TREATMENT AND PROTECTIVE COATINGS ON THE FATIGUE RESISTANCE OF TYPE ZhS6K HEAT-RESISTANT ALLOY

Kiev PROBLEMY PROCHNOSTI in Russian No 8, 1976 pp 10-15 manuscript received 19 Dec 75

[Abstract] Castile heat-resistant type ZhS6K nickel alloy blades are widely used in turbine building for jet aircraft. The blades are made by investment casting with subsequent heat treatment; however, the heat treatment is a long and expensive process and leads to impoverishment of the surface layers with the alloying elements, causing deterioration in strength characteristics. The authors therefore studied the strength and fatigue properties of this alloy following casting and typical heat treatment and in the non-heat-treated state to estimate the influence of heat treatment on fatigue strength at high temperatures. It is found that typical heat treatment increases fatigue strength but slightly, both for specimens without
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USSR

ISHCHENKO, I. I., OMEL'CHENKO, V. I., SINAYSKIY, B. N., POGREBNIYAK, A. D.,
BANAS, P. S., REZNIK, M. I., PROBLEMY PROCHNOSTI No 8, 1976 pp 10-15

coatings and for coated specimens. Consequently, elimination of heat treatment leads to an insignificant change in fatigue strength within the durability range studied (10^5 - $4 \cdot 10^7$ cycles).

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USSR

UDC 621.791.4:539.378.3

KAZAKOV, N. F., Doctor of Technical Sciences, SERGEYEV, A. V., Candidate of Technical Sciences, and LAKIN, N. A., engineer

DEVICES FOR PRECISION MEASUREMENT OF PRESSURE AND DEFORMATION IN DIFFUSION WELDING

Kiev AVTOMATICHESKAYA SVARKA in Russian No 7(280), Jul 76 pp 70-71

[Abstract] A description of instrumentation for registration and recording of pressure and deformation to be used in conjunction with the SDVU-50 vacuum diffusion welder. The pressure is applied to the parts to be joined by a mechanical gear box through a rod. Pressure is determined by a DOSM dynamometer with provision for compensating for the pressure differential due to the evacuation of the welding chamber. Deformation is registered by a dial indicator and a 6MKh5S mechanotron tube connected to a KSP-4 meter. The electronic instrumentation has 60 sensitivity ranges, enabling highly accurate registration of both small and large deformations. Reference 1 Russian.

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USSR

KOZUB, YU. I., BOGOMOLOV, A. V., and KUL'CHITSKIY, N. M., Institute of Problems of Strength, Academy of Sciences Ukrainian SSR

UNIVERSAL CHAMBER FOR HIGH-TEMPERATURE MECHANICAL TESTS (UP TO 2000°C)

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 42, Nw 7, 1976 pp 888-890

[Abstract] A design of a chamber is presented which is intended for testing composite materials based on metals and graphite. The test chamber can be used for the determination of ultimate strength and yield limit during short-duration static conditions, and to record creep curves during testing for creep and endurance limit. The chamber design makes it possible to record directly such testing parameters as loads, longitudinal strain and specimen temperature. Testing can be carried out in vacuum up to 10^{-5} mm Hg or in argon, helium and other inert gases at 20 to 2000°C. Specimens in the chamber can be heated and cooled according to a predetermined regime. Figures 1.

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USSR

AN INSTALLATION FOR MAKING TITANIUM SPONGE

Moscow TSVETNYYE METALLY in Russian No 5, May 76 inside back cover

[Abstract] A brief description is given of a new Soviet installation for making titanium sponge by the Kroll process. The reactor cover with fittings for evacuation and for charging is hermetically tight. The magnesium chloride formed during reduction is periodically removed from the reactor, and when reduction is completed the residues of magnesium and magnesium chloride are removed to the condenser by vacuum separation at 960-1020°C. The new unit ensures 98.5% extraction of high-grade sponge from titanium tetrachloride, and reduces the cost of the finished product by 10-12%. The condenser cooling system is improved and can be regulated, and the process of reduction and vacuum separation is automated. The impurity content in the titanium sponge is less than (in %): 0.06 iron, 0.04 oxygen, 0.02 nitrogen, 0.01 carbon and 0.01 silicon. One of these units has been in operation in the Soviet Union since 1972. The invention has been patented in Great Britain, the United States and Japan.

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USSR

UDC 620.171

MARKOCHEV, V. M., GOL'TSEV, V. YU., and BOBRINSKIY, A. P., Moscow
Engineering Physics Institute

DETERMINATION OF THE CRITICAL CRACK OPENING DISPLACEMENT

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 42, No 7, 1976 pp 866-868

[Abstract] A crack opening displacement (COD) gauge is described which permits continuous determination of the true COD at different temperatures and in aggressive media. The dual gauge consists of two separate gauges mounted in such a way that they produce independent measurements. The COD gauge can be used in furnaces at high temperature and in cooling chambers because their ring elastic elements with tensoresistors are located outside of any confined places containing the parts under test. Displacements (Δ_{1c} and Δ_{2c}) measured by both units at maximum load are used for the determination of the critical COD (δ_c). The gauge can be used at -150 to +20°C. Figures 4; references 5: 2 Russian, 3 Western.

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USSR

UDC 621.778:426.621.892

ZHILKIN, V. Z., and LATOKHIN, A. D.

LUBRICATING COMPOSITIONS FOR DRAWING WIRES OF NICKEL AND ITS ALLOYS

Moscow TSVETNYYE METALLY in Russian No 5, May 76 pp 60-61

[Abstract] Tests were done with five soap-based lubricants for preventing adhesion in drawing nickel and nickel-alloy wire. The optimum lubricant composition is 62-70% common soap, 8% molybdenum disulfide, 15-20% lime and 6-10% graphite. The lubricant coating is converted by annealing to a tight film on the wire that prevents adhesion between turns. Use of the lubricant extends the life of drawing dies by a factor of 2.4, and eliminates the operation of pretreating the wire surface with subsequent application of a lime-and-salt coating.

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Mechanical Properties

USSR

UDC 620.178.2:539.4.012

KUDRYASHOV, V. G.

DETERMINATION OF THE VISCOSITY OF RUPTURE UNDER STATIC AND CYCLICAL LOADINGS

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 21-25

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the problem of estimating the truth of defined values of rupture viscosity; the insufficiency of earlier suggested empirical criteria for reliability of values of K_{Ic} is demonstrated and the truth of K_{Ic} , it is suggested, should be determined for each specimen by measuring the growth of a crack Δa with static loading to load P_Q . This requires that the specimen be unloaded after load P_Q is reached and that the fatigue crack be grown by 2-3 mm in order to fix the picture of growth of the crack during the preceding static loading. Measurement of the growth of the crack Δa is performed at the center of the thickness of the specimen; if Δa is over 2%

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USSR

KUDRYASHOV, V. G., METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV No. 8, 1976 pp 21-25

of the initial crack length, the test is considered reliable. It is shown that with properly performed testing, the viscosity of rupture under planar deformation conditions is independent of the geometry of the specimen or the loading conditions.

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USSR

UDC 678.067.5

AMMER, S. A., DERGUNOVA, V. S., DAVYDOV, YU. A., KILIN, V. S., LUKIN, A. P., MOSKALENKO, A. G., and SULAYEVA, L. YA., Voronezh Polytechnic Institute and Moscow

AN INVESTIGATION OF THE MECHANICAL PROPERTIES OF CARBON FIBERS WITH PROTECTIVE COATINGS OF REFRACTORY CARBIDES

Riga MEKHANIKA POLIMEROV in Russian No 3, May-Jun 76 pp 536-538 manuscript received 3 Mar 75

[Abstract] A study was made of the protective properties of refractory coatings by the internal friction method and of the effect of these coatings on the mechanical properties of the fibers. Silicon and zirconium were precipitated on VMN-4 carbon fibers in the gaseous phase. Coating thicknesses ranged from 0.1 to 10% of mass. Fibers without obvious surface defects were then selected for testing in a vacuum of $5 \cdot 10^{-5}$ mm Hg at temperatures in the range 900-1200°C. Reduction of the vacuum resulted in increased oxidation processes and increased high temperature internal friction. Heat treatment in a low vacuum increased the high temperature base of internal friction by a factor of 4 to 5. The coatings did not appear to be homogeneous, but seemed to consist of island-like components joined into an apparent unit.
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USSR

AMMER, S. A., DERGUNOVA, V. S., DAVYDOV, YU. A., KILIN, V. S., LUKIN, A. P., MOSKALENKO, A. G., and SULAYEVA, L. YA., MEKHANIKA POLIMEROV No 3, May-Jun 76 pp 536-538

Reduced strength occurred when the fibers were stretched, which may be related to internal tensions at the interface of materials due to differing coefficients of thermal expansion. Figures 3; references 9: all Russian.

2/2

USSR

UDC 620.172.251.1:669.71

KALININA, A. P., KHOVOV, V. M., KURKIN, S. A.

MECHANICAL PROPERTIES OF THE ALLOYS AMg5 AND AMg6 AT -196°C

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian
No. 7, 1976 pp 21-23

[Abstract] A study was made of the aluminum alloys AMg5 and AMg6, which have good weldability and rather high mechanical properties. Tests were performed on three types of specimens: flat to determine the mechanical properties in monaxial extensions; with central notch to determine local plasticity at the notch; in biaxial extension (without a notch) to determine the maximum true deformation and true stress. It is found that at cryogenic temperatures, it is preferable to use AMg5 alloy, since it has higher mechanical properties than AMg6 alloy.

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USSR

UDC 669.295:537.32

LESNAYA, M. I., KASHCHUK, V. A., MAL'KO, P. I., Kherson, Tomsk

CERTAIN PHYSICAL PROPERTIES OF TITANIUM ALLOY IN THE RANGE OF 100-350°K

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 4, Jul-Aug 76
pp 159-160 manuscript received 19 Nov 74

[Abstract] The effect of alloying elements such as vanadium, chromium, manganese, iron, cobalt and nickel on the specific electric resistance, thermal conductivity and thermo-electromotive force of titanium was studied in the range of 100-350°K. It was found that alloying of titanium with V, Cr, Fe, Co and Ni increases its specific electric resistance and its microhardness. Thermal conductivity of all the investigated alloys decreases with increasing content of alloying metals. Anomalies of thermal conductivity on temperature dependence were observed in Ti-V and Ti-Cr alloys. Figures 2; references 2: both Russian.

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USSR

UDC 669.018.95:621.7.073

KIPARISOV, S. S., NARVA, V. K., KOPYSKIY, B. D., ZONNENBERG, I. S.,
TSEYTINA, I. L., TASHLYKOV, A. M., Moscow Institute of Steels and Alloys;
All Union Correspondence Machine Building Institute

PROPERTIES OF SINTERED MATERIALS BASED ON TITANIUM AND CHROMIUM CARBIDES
AND THEIR APPLICATION IN ISOTHERMAL DEFORMATION

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in
Russian No. 4, 1976 pp 76-81 manuscript received 26 Jan 76

[Abstract] The use of composites based on refractory carbides with various heat-resistant binders for hot isothermal deformation is promising, since the thermal shocks, dynamic loads and high specific pressures causing crack formation in sintered materials are absent. A study was made of composites containing 45-75 mass % titanium carbide cemented with alloy ZhS6-K, as well as materials with 70 mass % chromium carbide and nimonic binder. The static strength, influence of loading time or deformation rate on deformation resistance and adhesion stability of the materials were determined. The compressive strength, bending strength, static yield point, hot hardness and scale-formation resistance were studied. It was determined

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USSR

KIPARISOV, S. S., NARVA, V. K., KOPYSKIY, B. D., ZONNENBERG, I. S.,
TSEYTINA, I. L., TASHLYKOV, A. M., IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY,
TSVETNAYA METALLURGIYA No. 4, 1976 pp 76-81

that sintered alloys based on titanium and chromium carbides can be used as tool materials for isothermal deformation, and can also be used at working temperatures up to 900°C for brief loading, for example in the deformation of ferritic steels, certain titanium alloys, etc. Sintered alloys have the obvious advantage over cast materials of easy manufacture of complex shapes by mechanical working of platicized or partially sintered blanks.

2/2

USSR

UDC 621.762

KIPARISOV, S. S., NARVA, V. K., LOSHKAREVA, N. S., IVANOV, A. D., Moscow
Institute of Steels and Alloys

STUDY OF THE CONDITIONS OF SINTERING OF TITANIUM CARBIDE-STEEL MATERIALS
IN VARIOUS MEDIA

Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, 1976 pp 46-50 manuscript
received 10 Jul 75

[Abstract] A study is made of the conditions of production of TiC-steel materials for stamping tools by sintering in a vacuum, in argon, and in hydrogen. Optimal compositions of steel binders with satisfactory wetting characteristics of TiC in hydrogen are established. The properties of the sintered material are investigated. It is established that sintering of materials in hydrogen does not allow the production of pore-free, high-quality specimens.

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USSR

UDC 621.762:669.018.44

TUMANOV, A. T., PORTNOY, K. I., BABICH, B. N., LYUKEVICH, V. I.
and BULYGIN, I. P.

ACHIEVEMENTS IN POWDER METALLURGY IN THE CREATION OF HIGH-TEMPER-
ATURE HEAT RESISTANT NICKEL ALLOYS

Moscow OBRABOTKA LEGKIKH I ZHAROPROCHN SPLAVOV [Treatment of Light
and Heat Resistant Alloys, Collection of Works] in Russian, Izd-
vo Nauka, 1976 pp 236-245

[From REFERATIVNYY ZHURNAL, METALLURGIYA No 7 1976 Abstract No
7G803]

[Text] A new direction in the treatment of heat resistant Ni al-
loys involves the fact that strengthening is achieved by the arti-
ficial introduction into the die of quite disperse and practically
non-interacting strengthening oxide particles up to the melting
point which effectively stabilize the microheterogeneous structure
formed during deformation and heat treatment. The authors examine
questions of producing semi-finished products from dispersion
strengthened alloys. Figures 5; references 12. Authors' abstract.

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USSR

UDC 621.357.7:669.245

SAMSONOV, G. V. (deceased), ZHUNKOVSKIY, G. L., LUCHKA, M. V., Institute of the Problems of Material Science, Academy of Sciences UkrSSR

STUDY OF THE FORMATION PROCESS OF TITANIUM-CARBIDE BASE COMPOSITE COATINGS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jun 76 pp 53-56 manuscript received 18 Jul 75

[Abstract] A study was made of the formation process and of certain properties of coatings formed by electrochemical deposition of nickel and titanium carbide in a nickel-chloride electrolyte containing 2-10 g/l titanium carbide powder with particle sizes ranging from 3 to 160 μm . The coatings were obtained in a bath with horizontal electrodes, the diagram of which is presented in the article. After deposition, the coatings were annealed for 3-5 hours in vacuum at a temperature of $900 \pm 20^\circ\text{C}$. The obtained coatings were tested for wear resistance under conditions of dry friction against hardened steel. It was found that the best nonporous coatings were obtained from nickel-chloride electrolyte containing 30 vol% of titanium carbide powder with particle sizes of 20-50 μm , TiC powder concentration 2 g/l, cathode current density $20\text{A}/\text{dm}^2$, and ratio of electrolyte mixing time to the particle sedimentation time 45/15 s. Figures 3; tables 2; references 5: all Russian.
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USSR

UDC 621.762.5:620.1

KARPINOS, D. M., TUCHINSKIY, L. I., SAPOZHNIKOVA, A. B., VISHNYAKOV, L. R., Institute of the Problems of Material Science, Academy of Sciences UkrSSR

SINTERING OF TWO-PHASE COMPOSITES CONTAINING UNDEFORMABLE INCLUSIONS

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jun 76 pp 26-31 manuscript received 7 Apr 75

[Abstract] An equation is proposed for calculating the sintering kinetics of two-phase porous materials in which one of the phases behaves as an undeformable body. A case is considered in which an undeformable phase consists of fibers randomly arranged in the sintered matrix material. Composites with disperse inclusions are considered as a particular case of the reinforced material when the ratio of the fiber length to its diameter is close to 1. A kinetic equation of sintering is obtained which determines the relation between the matrix porosity geometry and the volumetric concentration of the fibers. The equation permits plotting of sintering curves of a two-phase composite from the known sintering curves of the one-phase matrix material. Experimental verification of the obtained dependences performed on the systems (copper-randomly oriented tungsten fibers, and titanium-disperse inclusions of zirconium carbide) showed good agreement of the theory with the experiment. Figures 5; equations 16; references 2: 1 Russian, 1 Western.
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USSR

UDC 621.762.4.04(088.8)

MUSIKHIN, A. M., Institute of the Problems of Material Science, Academy of Sciences UkrSSR

ROLLING OF POROUS SHEETS FROM ELECTROLYTIC TITANIUM POWDER

Kiev POROSHKOVAYA METALLURGIYA in Russian No 7, Jun 76 pp 13-16 manuscript received 24 Jan 76

[Abstract] Porous articles made of titanium powder are used for filtering various liquids and gases. Rolling of electrolytic titanium powders into sheets was investigated. Titanium powders of various particle sizes and containing varying amounts of impurities were rolled and then sintered in a vacuum furnace and in argon medium at a temperature range of 800-1010°C. The obtained specimens were tested for tensile strength and penetrability. On the basis of the results, a method was developed for production of 400 x 400 mm porous sheets from PTER-3 electrolytic titanium powder. Figure 1; tables 3; references 8: all Russian.

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USSR

UDC 621.762:621.892:669.018.4

SAMSONOV, G. V., GAYEVSKAYA, L. A., Institute of Problems of Material Science, Acad. Sci. UkrSSR

ABRASIVE PROPERTIES OF MICROPOWDERS OF REFRACTORY METAL CARBIDES

Kiev POROSHKOVAYA METALLURGIYA in Russian No 8, 1976 pp 60-63 manuscript received 25 Jun 75

[Abstract] A study is made of the influence of the mechanical properties of transition metal carbides of groups IV, V and VI on the quality of the surface work and the productivity of the abrasive finishing process. It is established that as the plasticity of the carbides increases in each group (TiC→ZrC→HfC and VC→NbC→TaC), a drop is observed in the productivity of the process and an improvement is seen in the quality of the surface. The increasing plasticity of carbides upon transition from group IV to group V and further to group VI (TiC→NbC→WC), on the other hand leads to an increase in productivity of finishing, with a concomitant increase in roughness of the surface produced. This change in abrasive properties of carbides results from the difference in mechanism of the change in mechanical properties of the carbides in these directions.

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Refractory Materials

USSR

UDC 666.762.1-494.017:620.173.2

GAODU, A. N., VOL'FSON, R. YE., and SAYENKO, YE. P., Ukrainian Scientific Research Institute of Refractory Materials; PANFEROV, V. M., and KOROL', Ye. Z., Institute of Mechanics, Moscow State University

THERMOMECHANICAL AND DEFORMATION PROPERTIES OF HEAT-INSULATING REFRACTORY FIBERS

Moscow OGNEUPORY in Russian No 7, Jul 76 pp 51-54

[Abstract] The study involved investigation of plates formed by vacuum and by saturation lamination of china clay fibers with a binder of polyvinyl acetate. The essential quality being tested was the ability of fibrous materials to be compressed without failure under load and to return to normal shape after unloading. Cylindrical specimens 50 mm X 40 mm were investigated, for compression in a single axis, creep, and durability in the heat range of 400-1100°C. Saturation with an organic binder proved to reduce deformation of heat-insulating plates in the range 20-600°C. The tested heat-insulating plates based on china clay fibers can be used as expansion and structural materials for air heating devices of blast furnaces, including large models, since they can bear loads of up to 1 kgs/cm² for prolonged periods in the range of 20-1100°C.

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USSR

UDC 666.762.11:621.793.14:669.718

KARKLIT, A. K., LEVCHUK, V. V., and MORGUN, L. V., All-Union Institute of Refractory Materials; SUMAROKOV, V. N., and MURASHKO, R. YE., All-Union Scientific Research Institute of Metal Toolmaking

CORUNDUM CRUCIBLES FOR VAPORIZING ALUMINUM IN A VACUUM

Moscow OGNEUPORY in Russian No 7, Jul 76 pp 46-50

[Abstract] The working conditions for vaporizing materials involve prolonged contact with heated aluminum and its vapors in a vacuum of 10⁻⁵ mm Hg, and relatively rapid temperature changes during the starting and stopping of the vaporizer. The crucible should not produce contaminating substances or vapors in the vacuum chamber. Various materials tested possessed some of the required characteristics. Laboratory specimens with differing granular structures were tested for thermal stability, density and durability of the materials tested: zirconium dioxide, titanium oxide and magnesium oxide. The binder tested was either bakelite or a silicon compound. Results indicated that the stability of crucibles was affected by their composition, physical properties and dimensions. Materials based on corundum proved to have good prospects for large crucibles utilized in industrial vacuum rolling of aluminum. Crucibles with high fireclay cement binder assure long-term service (of several hours), and these are recommended for industrial testing. Tables 3; figures 3; references 4: all Russian.

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USSR

UDC 620.174.24:669.14.018.298

POTAK, YA. M., VOZNESENSKAYA, N. M., POKROVSKAYA, N. G.

CRITERION FOR ESTIMATION OF THE STRUCTURAL STRENGTH AND RELIABILITY OF HIGH-STRENGTH STEELS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 11-16

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the criterion for estimation of high strength steels considering the actual conditions of their use. The most important mechanical characteristic in addition to low cycle fatigue resistance is K_{Ic} , a high value of which is achieved in steels with regulated austenite content. Attention is given to stress corrosion and sensitivity to metallurgical hydrogen. The predominant role of diffusion-mobile atomic metallurgical hydrogen in the development of hydrogen brittleness is demonstrated.

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USSR

UDC 669.15:620.183:004.12

ROMANIV, O. N., TKACH, A. N., ZIMA, YU. V.

STRUCTURAL ASPECTS OF THE VISCOSITY OF RUPTURE OF STRUCTURAL STEELS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 16-20

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the influence of structural factors on the parameter of viscosity of rupture K_{Ic} of hardened structural steels, as well as possible reasons for the sharp increase in K_{Ic} in low-tempered steels hardened after high temperature austenitization. A study is made of the influence of temper brittleness in structural steels on K_{Ic} . A $K_{Ic}^{-\sigma_{0.2}}$ diagram is used to analyze the possible levels of structural strength as a function of hardening modes and nature of alloying of steel. Pressing problems for future investigations are indicated.

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USSR

UDC 539.37:669.14:669.788

SARRAK, V. I., SERGEYEVA, T. K., FILIPPOV, G. A.

REGULARITY OF THE TIME DEPENDENCE OF STRENGTH OF HARDENED STEEL

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 25-30

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the influence of resting on the hydrogen permeability, tendency of hardened steel toward delayed rupture and hydrogen brittleness. It is shown that resting leads to an increase in hydrogen permeability and tendency of hardened steel toward hydrogen brittleness. With brief resting times, the phenomenon of hydrogen brittleness does not appear due to the high tendency of the steel toward delayed rupture.

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USSR

UDC 669.14.018.298'71:620.178.2

GOLOVANENKO, S. A., KONNOVA, I. YU., SERGEYEVA, T. K.

RESISTANCE OF TYPE 10KH2GMA STEEL WITH ALUMINUM TO HYDROGEN EMBRITTLEMENT

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 30-33

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the influence of aluminum (0.07-2.0%) on the resistance of type 10KH2GMA steel to hydrogen embrittlement, as well as its mechanical properties and structure. After tempering at 750°C, the impact toughness and resistance to hydrogen embrittlement are maximal, while the yield point remains at a rather high level (45-50 kg/mm²). It is shown that with an increase in aluminum content over 0.8%, the long-term strength, yield point and impact toughness at -40°C decreased, while at >1% Al the loss in ductility exceeds the 40% threshold value at which the steel is unsuitable from the standpoint of resistance to hydrogen embrittlement. Metallographic studies establish that as the content of aluminum increases, polygonal ferrite appears in the structure of the hardened steel. Tempering at 750°C leads to separation of a carbide phase. The growth of internal stresses of the metallic matrix, and the presence of excess ferrite, decrease the long-term strength.

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USSR

UDC 620.178.2

PIRUSSKIY, M. V., BULANENKO, V. F.

CRACK PROPAGATION RATE AS A FUNCTION OF RESISTANCE TO CRACK MOVEMENT

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 33-35

[Translated from Author Abstracts provided in the Journal]

[Text] The temperature-rate dependence K_{ID} is presented for 17G1S steel. The values of parameter K_{ID} are determined by impact bend testing of standard specimens with notch radius 1 and 0.25 mm, as well as specimens with a fatigue crack at temperatures from -20 to -100°C. A change in the value of K_{ID} leads to a change in the speed of a brittle crack with otherwise equivalent conditions. For 17G1S refined steel with a value of K_{ID} higher than steel produced by the ordinary method, a lower brittle crack propagation rate is observed under identical test conditions. A slight increase in the absolute value of K_{ID} is accompanied by a sharp decrease

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PIRUSSKIY, M. V., BULANENKO, V. F., METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV No. 8, 1976 pp 33-35

in the crack growth rate. This leads to the necessity of producing steels with high dynamic brittle crack propagation resistance.

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USSR

UDC 620.18:620.178.3

SHUR, YE. A., KISELEVA, T. N.

INFLUENCE OF THE STRUCTURE AND CHEMICAL COMPOSITION ON VIABILITY OF STEEL

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 39-45

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the influence of austenitic and ferritic grain size, dispersion, shape, quantity and dimensions of carbides, as well as the content of carbon, nickel and silicon in the steel on fatigue crack propagation rate, which is compared to the strength, ductility, characteristics of resistance of the steel to brittle rupture and effect of stress relaxation. It is established that the ferritic and austenitic grain size does not influence the development of fatigue cracks. The dispersion, shape, number and size of carbides, as well as the content of carbon, nickel and silicon, have a significant influence on the duration of development of fatigue cracks (viability of the steel). Comparison of the structural characteristics studied, mechanical properties and relaxation

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USSR

SHUR, YE. A., KISELEVA, T. N., METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV No. 8, 1976 pp 39-45

effect with the viability of the steel shows that there is no general relationship between them, indicating that viability is an independent property of the steel, not unambiguously related with any of its other properties.

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USSR

UDC 621.78.019.4:620.178.746

SEREBRIN, S. M., RAKHSHTADT, A. G., SEMENOV, V. M.

INFLUENCE OF THE DECARBURIZED LAYER ON THE CHARACTERISTICS OF RUPTURE OF 60S2 STEEL

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 48-50

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the influence of surface decarburization on the characteristics of impact rupture of type 60S2 spring steel. In order to separate the impact toughness into its components, the methods of A. P. Gulyayev and Otani are used. It is shown that the increase in impact toughness with a decarburized layer results from an increase in the "work of crack formation," which depends on the degree of decarburization.

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USSR

UDC 620.184:6:620.178.2

KOVALEV, A. I.

FRACTOGRAPHIC EVALUATION OF THE RESISTANCE OF STEEL TO BRITTLE RUPTURE

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 54-56

[Translated from Author Abstracts provided in the Journal]

[Text] The method of determination of the critical brittleness temperature from the form of the fracture (portion of viscous component in the zone of planar separation) is used to estimate the resistance of steel to brittle rupture during fractographic investigation on a scanning electron microscope. It is shown that this method is productive in studies of steels with various sizes of primary austenitic grain. The decrease in grain size leads to an increase in resistance to brittle rupture in type 35G2 and 40KH2N3F1 steels after low and high tempering.

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USSR

UDC 620.187:660.15-194.56

GEORGIYEVA, I. YA., GULYAYEV, A. A., KONDRAT'EVA, YE. YU.

DEFORMATION TWINNING AND MECHANICAL PROPERTIES OF AUSTENITIC MANGANESE STEELS

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 56-58

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the mechanical properties of steels Fe-(14-40) Mn-(0.02-0.53)C near the metastable equilibrium boundary. An anomalous increase is discovered in ductility and strength upon transition through the metastable equilibrium boundary of the γ and δ phases. It is shown that the observed anomaly of the mechanical properties of the steels is related to deformation twinning.

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USSR

UDC 620.187:620.17:669.14.018.29

ZIKEYEV, V. N., KARCHEVSKAYA, N. I., POPOVA, L. V., BOGATOVA, N. L.

STRUCTURE AND PROPERTIES OF IMPROVED STRUCTURAL STEELS MODIFIED WITH CHROMIUM NITRIDES

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 59-61

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the kinetics of separation and dissolution of chromium nitrides in hardened steels types 20KH3M and 20KHNM, alloyed with nitrogen, as a function of tempering temperature. It is shown that the optimal tempering for such steels is 600-650°C. In this case, chromium nitrides are separated in a finely dispersed sorbite structure, which produces sufficient strength in combination with high toughness characteristics of the steels studied.

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USSR

UDC 669.018.29-156-157-122:620.17

BERNSHTEYN, M. L., ODESSKIY, P. D., and DERKACHEVA, S. N., Moscow Institute of Steel and Alloys

OBTAINING HIGH-STRENGTH STRUCTURAL STEELS THROUGH THERMOMECHANICAL HARDENING PROCESSES

Moscow IVUZ. CHERNAYA METALLURGIYA in Russian No 7, 1976 pp 157-161 manuscript received 15 Sep 75

[Abstract] The most durable materials for structural use today are thermally hardened plate steels with yield points of 60 kgs/mm². To obtain steels with greater strength, the present study sought to show the possibility of thermomechanical treatment of a steel alloyed with molybdenum and nitrides, designated 12GN2MFAYu. This steel meets the specifications for structural steel after thermal processing. After experimental treatment, the mechanical properties were evaluated by tests for tension, brittleness, and structural changes. Results indicated that the treated steel acquired a new level of quality including a yield point of 75 kgs/mm², without reducing ductile strength. Analysis with an electron microscope revealed an improved dispersion carbonitride phase when compared to normally hardened steel, and a more durable granular structure in general. Figures 5; tables 2; references 6: all Russian.

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USSR

UDC 669.14.018.8+669.14.018.44]:539.37

LITINSKIY, YU. D., KULISH, L. I., All-Union Scientific Research Institute of Pipes

INCREASING THE DEFORMATION CAPACITY OF STAINLESS AND HEAT RESISTANT TWO-PHASE STEEL DURING COLD AND HOT ROLLING

Moscow STAL' in Russian No 7, Jul 76 pp 654-656

[Abstract] An interrelationship is established between the degree of development of the $\alpha \rightarrow \gamma$ conversion at the deformation focus in steels of the martensite-ferrite class and the position of the critical brittleness temperature T_{cr} . The formation of the optimal phase composition under the influence of hot plastic deformation may be one means of increasing the deformability of two-phase martensite-ferrite steels during subsequent cold rolling, as well as austenite-ferrite steels directly during hot deformation. Modes are suggested for high temperature thermomechanical treatment of corrosion-resistant and heat-resistant two-phase steels providing for the creation of the required structure of the metal as a result of occurrence of phase conversions in the deformation focus.

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USSR

UDC 669.187.2

TAGER, L. R., KLYUYEV, M. M., MILOVANOV, I. F., BIKEZINA, G. S., KULTYGINA, L. N., Electrostal' Plant

OPTIMIZATION OF PROCESSES OF REFINING HIGH ALLOY HIGH SPEED STEELS

Moscow STAL in Russian No 7, Jul 76 pp 611-613

[Abstract] The equilibrium concentration of oxygen was calculated on the example of the series-produced high carbon high speed steel R6M5 in order to estimate the most favorable thermodynamic conditions for deoxidation of steel alloys. The content of oxygen in the highly alloyed melt during the reducing period of electric melting is determined by the concentration of silicon in the melt. This is demonstrated experimentally. The higher reducing capacity of silicon carbide in comparison with traditional deoxidizers (ferrosilicon and coke) is experimentally demonstrated. The use of a deoxidizing mixture based on silicon carbide with alumina and cryolite has a favorable influence on the process of refining of high speed steel, allowing a significant reduction in the oxygen and sulfur content in the finished metal.

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USSR

UDC 621.7.044.2

CHELYSHEV, N. A., CHERVOV, G. A., Siberian Metallurgical Institute

THE PROBLEM OF THE HIGH-SPEED DEFORMATION AND RUPTURE OF STEEL

Moscow IVUZ., CHERNAYA METALLURGIYA in Russian No 8, 1976 pp 82-85
manuscript received 21 Oct 75

[Abstract] This work is dedicated to the study of the kinetics of the flow of metal in the area of a stress concentrator upon high-speed bending of type 45 steel. Specimens measuring 70 x 4 x 16 mm had notches 0.25 mm in radius and 3 mm deep. Analysis of the results shows that high-speed deformation of the steel ($\dot{\epsilon}=5 \cdot 10^4 \text{ s}^{-1}$) causes some increase in the maximum deformation (by 15%) in comparison to static testing and that the high value of relative deformation of the apex of the notch (100%) results from the flow of the metal from adjacent areas.

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USSR

UDC 669.15'24:620.172.251.2

GAYDUKOV, M. G., LEVIT, V. I., PETROVA, S. N., SADOVSKIY, V. D., SMIRNOV, L. V., Institute of Metal Physics, Acad. Sci. USSR

THE PROPERTIES OF HEAT RESISTANCE OF SINGLE CRYSTALS OF KhN77TYur ALLOY AFTER HEAT AND THERMOMECHANICAL TREATMENT

Moscow FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 41, No 6, Jun 76 pp 1274-1279 manuscript received 22 Oct 75

[Abstract] A study is made of the influence of high temperature thermomechanical treatment on the creep characteristics of a single crystal of KhN77TYuR alloy in the 650-680°C temperature interval. The structure and properties of heat resistance are studied in this temperature range using single crystals of two different orientations grown from a melt after both ordinary heat treatment and high temperature thermomechanical treatment, by means of upsetting. After high temperature thermomechanical treatment, some increase was observed in the time to rupture, plus a decrease in the rate of stable creep of single crystals, the orientation of the growth axis of which was close to the [153] direction, with significant deterioration in these characteristics in single crystals with orientation of the growth axis close to the [111] direction. The substructure formed

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USSR

GAYDUKOV, M. G., LEVIT, V. I., PETROVA, S. N., SADOVSKIY, V. D., SMIRNOV, L. V., FIZIKA METALLOV I METALLOVEDENIYA Vol 41, No 6, Jun 76 pp 1274-1279

as a result of upsetting by 25-30% at 1150°C has no significant influence on the hot strength characteristics of single crystals at temperatures for which the hardening effect of the γ' phase is conserved.

NOVIKOV, I. I., PORTNOY, V. K., ZHURAVLEVA, N. S., IL'YENKO, V. M.,
LEVCHENKO, V. S., Moscow Institute of Steels and Alloys

THERMOMECHANICAL TREATMENT FOR THE PRODUCTION OF A SUPERPLASTIC SHEET OF
ZINC-ALUMINUM ALLOY

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in
Russian No 4, 1976 pp 98-103 manuscript received 26 Jul 75

[Abstract] The production of a superplastic sheet of zinc-aluminum alloy of monotectoid or near monotectoid composition by rolling of hardened blanks with self-heating provides the best combination of superplasticity indicators of all known methods. It is recommended that rolling be begun at the maximum self-heating temperature of the hardened blank. It is shown that if rolling is begun at the maximum temperature, the decomposition of the supersaturated aluminum solution continues during plastic deformation, that is, this treatment is thermomechanical. In the hardened alloy of zinc with 22% Al, a grid of extended zinc and aluminum phase particles is discovered upon microscopic examination, corresponding to the grid of high temperature phase boundaries. It is shown that this grid of extended phase particles, causing a deterioration in superplasticity indicators, is absent when the product is rolled after hardening.

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USSR

UDC 669.295'293:621.785.3

MALTSEV, M. V., Gor'kiy Polytechnical Institute

INFLUENCE OF THE FORM OF DEFORMATION ON DECOMPOSITION OF THE METASTABLE
 β PHASE IN VT16 ALLOY

Moscow FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 41, No 6, Jun 76
pp 1225-1231 manuscript received 4 Aug 75

[Abstract] A study is made of the influence of the type of deformation on phase conversions in VT16 alloy hardened from a temperature of 740°C to the structure containing the maximum quantity of metastable β phase plus a very small quantity of α'' martensite. Plastic deformation, regardless of its type, causes conversion of the β phase to α'' martensite in VT16 alloy hardened from 740°C. As the degree of deformation increases, a tendency is noted toward gradual conversion of the rhombic structure of the α'' martensite to a hexagonal structure; with compressive deformation this conversion is more clearly expressed than with extension. The lattice of the β phase, which does not undergo conversion to the α'' martensite, becomes tetragonal with a c/a ratio of less than one in compression and greater than one in extension. Deformation causes the formation of phases 1/2

USSR

MALTSEV, M. V., FIZIKA METALLOV I METALLOVEDENIYE Vol 41, No 6, Jun 76
pp 1225-1231

with higher specific volume than in the initial β phase. The change in volume is directed, namely in extension. The greatest parameter of the phases formed coincides with the direction of deformation; in upsetting it does not.

USSR

UDC 669.017

SALISHCHEV, G. A., KAYBYSHEV, O. A., GORDIYENKO, YE. G., CHERNYAKOV, M. I.,
Ufa Aviation Institute

INFLUENCE OF INITIAL STRUCTURE ON THE SUPERPLASTICITY EFFECT IN VTZ-1
TITANIUM ALLOY

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in
Russian No. 4, 1976 pp 104-107 manuscript received 1 Jul 75

[Abstract] A study is made of the influence of initial structure produced by two processing methods -- hot rolling in the ($\alpha + \beta$) area and in the β area, and of temperature-rate conditions of deformation on the appearance of the superplasticity effect in VTZ-1 two-phase titanium alloy. The results of testing showed that the mechanical properties of the alloy in both structural states depend essentially on the deformation temperature. As the deformation temperature increases, relative elongation increases, reaching its maximum at 925°C for the alloy in both initial structural states. At the optimal temperature, both states show a clear dependence of relative elongation on deformation rate. The maximum plasticity is at $\dot{\epsilon} = 7.4 \cdot 10^{-4} \text{s}^{-1}$. Thus, the superplasticity effect depends essentially

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SALISHCHEV, G. A., KAYBYSHEV, O. A., GORDIYENKO, YE. G., CHERNYAKOV, M. I.,
IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA No. 4, 1976
pp 104-107

on the conditions of hot deformation; the alloy, rolled in the β area of temperatures shows less plasticity, particularly showing higher flow stress in the initial stage of deformation. Superplasticity requires the formation of a stable fine grained equilibrium structure with near 1:1 ratio of α and β phases.

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USSR

UDC 669.295'721:620.1

CHERNETSOV, V. I. and TSEYGER, YE. N.

ON THE SOLUBILITY OF HYDROGEN IN TITANIUM ALLOYS THAT CONTAIN ALUMINUM

Moscow TSVETNYYE METALLY in Russian No 5, May 76 pp 67-68

[Abstract] Studies were done to determine whether aluminum increases the solubility of hydrogen in titanium. Ti-4Al alloy specimens were tested with and without hydrogenation (0.010% by mass). The specimens were broken on an impact tester in the initial state and after loading for 40 days at 31.2 kgf/cm². The loaded hydrogenated specimens showed a reduction in impact toughness by a factor of about 13, and were found to contain a hydride phase with hydride inclusions in the form of thin plates distributed throughout the metal, although no hydride phase was observed in either hydrogenated or untreated specimens that had not been loaded. It is concluded that hydrogen does not dissolve better in titanium alloyed with aluminum, but rather that the aluminum creates a metastable state for the hydrogen atoms, reducing their diffusion mobility and thus impeding the formation of a hydride phase.

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USSR

UDC 539.4.015

SEVERDENKO, V. P., PETRENKO, V. V., KALACHEV, M. I. and NOZDRIN, V. F.,
Moscow

FATIGUE OF DEFORMATION-HARDENED TITANIUM

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 89-92 manuscript received 31 Dec 75

[Abstract] An investigation is made of the influence that prehardening by plastic deformation in different stress schemes (tension, compression, pure shear) at temperatures of 20 and 100°C has on the fatigue strength of VTI-0 titanium. It is shown that plastic compression is better than stretching or twisting for prehardening to improve the fatigue properties of the metal. The segregation of finely dispersed particles of secondary phases as a result of preliminary dynamic deformation aging at 100°C increases the fatigue strength of titanium. References 3 Russian.

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USSR

UDC 669.295:539.371

MOROZ, I. A., BRYUKHANOV, A. A., IVANIY, V. S., Odessa Pedagogic Institute

DEVELOPMENT OF TEXTURE AND ANISOTROPY OF PROPERTIES OF ROLLED TECHNICAL
TITANIUM SHEETS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in
Russian No. 4, 1976 pp 114-118 manuscript received 29 Jan 75

[Abstract] A mathematical representation of elastic anisotropy of rolled sheets in the form of a harmonic Fourier series is used to study the texture and develop methods of control of elastic anisotropy and the texture it produces in rolling and of checking it during investigation of titanium. The process of texture formation of metals with hexagonal close packed lattice, the anisotropy of the properties of which is determined basically by the value of the second harmonic of Fourier analysis can be controlled by cross rolling with determination of the relationships of compression in the longitudinal and transverse directions. Anisotropy of Young's modulus for VT1-1 titanium with cross rolling can be varied within limits of 0-9%. In titanium with rather high final compression in one

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USSR

MOROZ, I. A., BRYUKHANOV, A. A., IVANIY, V. S., IZVESTIYA VYSSHIKH UCHEBNYKH
ZAVEDENIY, TSVETNAYA METALLURGIYA No. 4, 1976 pp 114-118

direction, a texture is established characterizing the deviation of poles [0001] in the PN direction by 30-40°; its type is independent of the state of the metal being rolled.

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USSR

UDC 669.295:620.174.25

LEVANOV, V. I., CHERNITSYN, A. I.

MECHANISM OF RUPTURE OF TITANIUM AT VARIOUS TEMPERATURES

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 7, 1976 pp 47-48

[Abstract] A study is presented of the mechanism of rupture at various temperatures of TG-110 titanium, remelted in an arc furnace. The fracture structure was studied by an electron microscope. At below-freezing temperatures, the deformation of titanium results from twinning. At higher temperatures, rupture occurs with viscous flow of the titanium. The $\alpha \rightarrow \beta$ conversion is accompanied by replacement of viscous flow by slipping in various planes.

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USSR

UDC 539.4

NIKITENKO, A. F., Institute of Hydrodynamics, Siberian Affiliate, Acad. Sci. USSR

CYCLICAL CREEP OF TITANIUM ALLOY

Kiev PROBLEMY PROCHNOSTI in Russian No 8, 1976 pp 51-53 manuscript received 1 Apr 75

[Abstract] This work continues studies of the strength properties of a titanium alloy, analyzing in particular its behavior under conditions of cyclical creep with a symmetrical loading cycle consisting of twisting at room temperature. The elastic-plastic characteristics and creep characteristics of the alloy were presented in earlier reports in this series. Thin-walled tubing and beams are tested in both homogeneous and heterogeneous stress states. It is established that under these conditions with moderate loading, the process of cyclical creep is almost always stable in nature. As stress rises, the duration of this stage is reduced, and the duration of the first and third stages -- cyclical hardening and softening -- is increased.

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USSR

UDC 669.245'28'27

POTAPOV, L. P., YEDNERAL, A. F., KIRIYENKO, V. I., and NIKANDROVA, YE. A.,
Institute of Metal Science and Metal Physics, Central Scientific Research
Institute of Ferrous Metallurgy imeni I. P. Bardin

STRUCTURE TRANSFORMATIONS IN NICKEL-MOLYBDENUM-TUNGSTEN ALLOYS

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 1, Jul 76
pp 90-98 manuscript received 30 Jul 75

[Abstract] Methods of electronic and x-ray diffraction and auto-ionic microscopy were used to investigate transformations in alloys containing Ni, with 13 at.% Mo, and 9.9 at.% W, and Ni + 13 at.% Mo, and 5.94 at.% W, with less than 0.06 at.% C, Si, S and P. Vaporization of surface atoms observed in an auto-ionic microscope increased with the addition of hydrogen, except with tungsten. The structure of the hardened compound was shown by the auto-ionic microscope to be a chaotic distribution of the alloying elements in the nickel framework, characterized by fluctuating concentrations or phases with the structure $L1_0M1$, OZK, and areas of the types $Ni_4(Mo,W)$, and $Ni_2(Mo,W)$. With annealing for 4-10 hours, the phase $Ni_2(Mo,W)$ disappeared completely, while particles of the phase $Ni_4(Mo,W)$

USSR

POTAPOV, L. P., YEDNERAL, A. F., KIRIYENKO, V. I., and NIKANDROVA, YE. A.,
FIZIKA METALLOV I METALLOVEDENIYE Vol 42, No 1, Jul 76 pp 90-98

increased to approximately 0.5 mk. Electron microscope and X-ray data indicated the formation of the phase $Ni_3(Mo,W)$ at this stage. Apparently, at high temperatures the $L1_0M1$ structure is the most durable. Alloying with tungsten apparently increases the Ni_4Mo+Ni_3Mo phases. Figures 7; references 14: 9 Russian and 5 Western.

USSR

UDC 621.791.01

YAKUSHIN, B. F., Candidate of Technical Sciences, and EYDEL'SHTEYN, V. YE., engineer, Kuybyshev

USING INDUSTRIAL TESTS TO EVALUATE THE TENDENCY OF NICKEL ALLOY TO CRACK IN THE HEAT-AFFECTED ZONE DURING WELDING

Kiev AVTOMATICHESKAYA SVARKA in Russian No 7(280), Jul 76 pp 28-29 manuscript received 29 Aug 75

[Abstract] Hot cracks near the weld are the main flaw in structures welded from precipitation-hardened nickel alloys. These cracks are hard to detect, and can be controlled only by changing production conditions, principally the welding technique. A method of industrial testing is developed to evaluate this cracking tendency. The test is designed to eliminate hot cracking in the weld itself, to maximize the sensitivity to cracks in the heat-affected zone, and to minimize expenditures of labor and material. The optimality criterion for test evaluation is the mean ratio of total crack length in the cross section to the length of the fusion line. The welds were made on butted bevel-edge plates of EP199 alloy in a single pass without backup. A tungsten electrode was used in argon. It was found that the probability of crack formation in the heat-affected zone is lowest for welding energy of 9000-12000 J/cm at 10-15 m/hr. References 5 Russian.
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USSR

UDC 621.791.052:620.18

BLASHCHUK, V. YE., GUREVICH, S. M., ONOPRIENKO, L. M., BOYEVA, G. YE., YE. O. Paton Electric Welding Institute, and SHELENKOV, G. M., Suma Machine Building Plant

INFLUENCE OF ELECTROMAGNETIC AGITATION OF THE WELDING BATH ON THE PROPERTIES OF JOINTS IN VT1-0 ALLOY

Kiev AVTOMATICHESKAYA SVARKA in Russian No. 8, 1976 pp 40-43 manuscript received 19 Nov 75

[Abstract] This article presents a study of the influence of welding with electromagnetic agitation of the bath on the mechanical properties and corrosion resistance of compounds of type VT1-0 titanium alloy. Before welding the edges of plates 200 x 400 x 6 mm, they were mechanically worked, washed in gasoline and ethyl alcohol. The specimens were assembled for butt welding without a gap in clamps and welded by a nonfusible tungsten electrode in argon using a modernized type ADS-1000-2EMP automatic welding machine. It was found that welding with electromagnetic agitation of the bath can increase the mechanical properties and corrosion resistance of joints. A technology is developed for mechanized and manual argon-arc welding of titanium with electromagnetic bath agitation as applicable to column apparatus of VT1-0 titanium, providing for the production of high quality joints.
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Miscellaneous

USSR

MIROSHNICHENKO, K., TASS Correspondent in Tomsk

ALLOYS WITH STRONG MEMORIES

Tallinn SOVETSKAYA ESTONIYA in Russian No 186 (9976) 12 Aug 76 p 3 cols 1-3

[Text] The simplest example of a metal "recalling" its shape can be found in all kinds of springs. When compressed, they seek to return to their original shape and state. This is a property of spring alloys, but there is another category of so-called thermoelastic alloys, for example nickel and titanium, which can "recall" more complex forms.

At the Siberian Physico Technical Institute, Tomsk University, active work is in progress in studying such alloys. Small wires, bent into the most amazing shapes, are straightened and then held to a lighted match. The heat causes them to bend back into the original shape.

"This phenomenon has been called 'the recall effect'," explained the director of the laboratory, Candidate of Physics and Mathematics Ye. F. Dudarev. "In contrast to chaotic movements of atoms during the heating of ordinary metals, thermoelastic alloys undergo a process in which the atoms in general move
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USSR

MIROSHNICHENKO, K., SOVETSKAYA ESTONIYA No 186 (9976) 12 Aug 76 p 3 cols 1-3

in a particular direction. This also explains the possible return to an original shape. Our scientists are working to produce such alloys."

For example, the Institute has developed a method for obtaining and processing an alloy that can "recall" not one, but two previous shapes.

There are broad prospects for the practical use of alloys with "recall," such as in various monitors for instruments, replaceable bushings for joints in pipelines, hermetic chambers with desealing capability without welding and soldering, etc.

USSR

UDC 669.285'784:669.285'784'24

KOTKO, V. A., MALASHENKO, I. S., TREFILOV, V. I., and FIRSTOV, S. A.,
Institute of Problems of Material Science, Academy of Sciences UkrSSR

CHANGES IN STRUCTURE AND MECHANICAL PROPERTIES IN ANNEALING ALLOYS OF
MOLYBDENUM AND CARBON AND MOLYBDENUM-CARBON-NICKEL

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 1, Jul 76
pp 140-145 manuscript received 20 Apr 75

[Abstract] The alloys tested were obtained by single electron-arc smelting in a vacuum of 10^{-4} . Oxygen and nitrogen content amounted to 0.003% and 0.005%, respectively. Ingots were forged at 1500°C into rods with a diameter of 8.5 mm and general deformation levels of 90-95%. Specimens were next annealed in vacuum at temperatures from 900 to 1600°C for an hour, and then placed under tension at varying temperatures before being examined in an electron microscope. Structural investigations took into consideration the possibility of the formation and disappearance of segregated accumulations of additives at granular boundaries. The appearance of an intensive diffusion contrast apparently is dependent on the formation of such segregated accumulations. Changes in granular boundaries apparently are involved in creep across those boundaries during heat treatment and alloying, since changes
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USSR

KOTKO, V. A., MALASHENKO, I. S., TREFILOV, V. I., and FIRSTOV, S. A.,
FIZIKA METALLOV I METALLOVEDENIYE Vol 42, No 1, Jul 76 pp 140-145

in contrast correlate with the mechanical properties of alloys. The introduction of nickel into the alloy prevents formation of segregated accumulations of additives and greatly increases the plasticity of Mo-C alloys. Figures 3; references 23: 20 Russian and 3 Western.

USSR

UDC 539.4

GARBER, R. I., GEYSHERIK, V. S., MIKHAYLOVSKIY, I. M., and FEDOROVA, L. I.,
Physico Technical Institute, Academy of Sciences UkrSSR

INVESTIGATIONS OF THE STRENGTH OF THIN FOILS OF TUNGSTEN

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 1, Jul 76
pp 155-159 manuscript received 6 Aug 75

[Abstract] A study was made of the tensile strength of thin tungsten foils 10^2 - $7 \cdot 10^2$ Å thick at 78°K. Stationary, impulse and pulsating methods of loading by electronic fields were used in the chamber of an auto-ionic microscope. Results showed that foils with granular boundaries near the surface had the least strength. Failure occurred between crystals and was observed where cell boundaries emerged onto the surface. The hystogram indicated that most specimens surpassed a durability level of 1500 kg/mm^2 , although the durability of the initial foil was only 300 kg/mm^2 . Impulse loading on surfaces in the vicinity of granular boundaries developed loads of 1800 kg/mm^2 , the local tensions reached approximately 300 kg/mm^2 on the faces of surfaces, and average loads were $220 \pm 400 \text{ kg/mm}^2$. In general, failure of specimens with thicknesses of 500 Å under a load of 1200 kg/mm^2 occurred after $1-5 \cdot 10^5$ cycles of pulsating electronic loading. Fatigue effects were not recorded in such microcrystals. Figures 5; references 6: all Russian.

1/1

USSR

UDC 538.632

VEDERNIKOV, M. V., DVUNITKIN, V. G., and METSNER, YE. P., Physico Technical
Institute imeni A. I. Ioffe, Academy of Sciences USSR

A CONTINUOUS HALL PROCESS FOR SAMARIUM AND YTTERBIUM AT HIGH TEMPERATURES

Sverdlovsk FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol 42, No 1, Jul 76
pp 203-205 manuscript received 8 Aug 75

[Abstract] The difficulties of measuring the Hall effect for rare metals can be overcome by using variable current and magnetic fields with a continuous automatic recorder. Phase transformations in samarium and ytterbium make those metals of special interest for such measurements, which were made on disks with dimensions of $0.2 \times 10 \times 20 \text{ mm}$. The specimens were investigated in the course of initial heating, without previous annealing. During later heating the character of temperature dependency was preserved but its absolute value grew noticeably. Results indicated that a continuous Hall process, which was highly sensitive to transformation, had no noticeable effect on hydrogen absorption during the measurements. The temperature dependency of ytterbium at low temperatures was very great, and it decreased with continued heating in a manner similar to that of semiconductors. Figures 2; references 12; 8 Russian, and 4 Western.

1/1

USSR

UDC 669.15'293-194

BELOKUROV, S. M., STARTSEV, V. A., UMRIKHIN, P. V., ZHUKOV, A. V.,
BERSHTEYN, L. I., Ural Polytechnical Institute

ALLOYING OF STEEL WITH NIOBIUM. REPORT 2.

Moscow IVUZ. CHERNAYA METALLURGIYA in Russian No 8, 1976 pp 44-47 manuscript
received 7 Dec 75

[Abstract] A study is made of the physical properties of synthetic slags in the system $\text{CaO-SiO}_2\text{-Nb}_2\text{O}_5$ of varying chemical composition and the influence on these properties of the addition of FeO and Al_2O_3 . Slags with basicity 1.5-1.7 with a niobium pentoxide content of 8 to 23% have minimum toughness. As concerns fusability, its lowest value is reached in slags with basicity 1.2-1.3. The nature of the influence of the concentration of Al_2O_3 and FeO on these properties of niobium slags is established. The results of the studies allow determination of the composition of the reducing mixture for direct alloying of steel with niobium, and a high degree of assimilation of the niobium is achieved (88%).

1/1

USSR

UDC 620.172.226

PISARENKO, G. S., KOVPAK, V. I., Institute of Problems of Strength, Acad.
Sci. UkrSSR

THE PROBLEM OF PREDICTING THE CHARACTERISTICS OF LONG-TERM STRENGTH FOR
METALS OPERATING UNDER HIGH TEMPERATURE CONDITIONS

Kiev PROBLEMY PROCHNOSTI in Russian No 8, 1976 pp 26-32 manuscript received
8 Jul 75

[Abstract] Based on the primary prerequisites of the theory of similarity, utilizing phenomenological equations relating time to rupture and stress by means of exponential dependences, a new dimensionless equation is suggested. It is established that the method of generalized stress diagrams is the most universal of all methods studied, since it allows the most reliable values of predicted characteristics of long-term strength to be produced.

1/1

USSR

UDC 546.831'26+546.882'26+546.883'26:539.261

SAMSONOV, G. V., TIMOFEYEVA, I. I., ROGOZINSKAYA, A. A., ADAMOVSKIY, A. A.,
and PRITULYAK, A. S., Institute of Problems of Material Science, Academy
of Sciences UkrSSR

X-RAY DIFFRACTION ANALYSIS OF TRANSITIONAL METAL CARBIDES THAT ARE USED AS
ABRASIVES

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 12, No 8, Aug 76 pp 1387-1389

[Abstract] Structural changes that take place in carbide grains of TiC, NbC, ZrC and TaC after their use in abrasive disks were studied by x-ray diffraction analysis. The above carbides with 160/125 grain size were used in disks for 30, 60 and 90 minutes (15 minutes corresponded to 1000 disk revolutions) before being subjected to x-ray diffraction study. Structural changes in carbide grains were judged on the basis of broadening the diffraction lines (111) and (333). The results obtained indicate that TiC has the highest abrasive properties and its elastic-plastic deformation during the disk operation was the lowest. The elastic-plastic deformation of ZrC, NbC and TaC was more extensive and their abrasive properties suffered because of it. With respect to the above properties these carbides can be arranged in the following order TiC - ZrC - NbC - TaC. With respect to time, the initial
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USSR

SAMSONOV, G. V., TIMOFEYEVA, I. I., ROGOZINSKAYA, A. A., ADAMOVSKIY, A. A.,
and PRITULYAK, A. S., NEORGANICHESKIYE MATERIALY Vol 12, No 8, Aug 76 pp
1387-1390

high abrasive property of TiC decreased rapidly, while in NbC and TaC this decrease was much slower and became stabilized after a certain time. Microdefects in the crystal lattice of TaC and NbC were responsible for the stabilization of their abrasive capability. These defects produced the self-strengthening effect in TaC and NbC and made them suitable for long operation. The density of dislocation in TaC and NbC along block boundaries became practically equal during long operation of abrasive disks. Figures 1; tables 2; references 12: 11 Russian and 1 Western.

USSR

UDC [546(723-31)]:543.226

YEGUNOV, V. P., LISOV, N. I., and POKSHCHAYEV, K. G., Kuybyshev Polytechnic Institute

THERMAL ANALYSIS OF THE PHASE COMPOSITION OF Fe-BASED OXIDE FILMS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 12, No 8, Aug 76 pp 1346-1348

[Abstract] Results are presented on the phase composition of ferromagnetic materials subjected to chemical polishing in an oxalic acid bath containing 25 g oxalic acid, 13 g H_2O_2 , 0.1 g H_2SO_4 and 1000 ml water. The chemical polishing of Fe-based materials on an oxalic bath for 30 minutes produced an oxide film having a magnetic induction of 12,000-15,000 gauss. Only about 15 minutes is needed to obtain an Fe oxide film of considerable thickness, with high electromagnetic properties. The differential thermal analysis (DTA) of this film indicates that the Fe oxide from oxalic bath possesses a complex structure, with a multicomponent solid phase system. Hypothetically, the following system can be assumed: $[Fe] \cdot FeO[Fe_3O_4]Fe_2O_3 \cdot [FeC_2O_4 \cdot 2H_2O]$. A magnetic transformation of Fe was clearly evident on DTA curves showing the occurrence of the thermal effect at 749-779°C. A magnetic soft material with a 14,300 gauss magnetic induction can be

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USSR

YEGUNOV, V. P., LISOV, N. I., and POKSHCHAYEV, K. G., NEORGANICHESKIYE MATERIALY Vol 12, No 8, Aug 76 pp 1346-1348

successfully prepared by treating the Fe powders in an oxalic acid bath, pressing at 15 ton/cm² and sintering at 700°C. Specific electric losses of such materials at $B = 0.5$ Tl (tesla unit) and 1000 Hz amount to 107 W/kg. Figures 1; references 5: 4 Russian and 1 Western.

USSR

UDC 669.183.067

PANIOTOV, YU. S., BAPTIZMANSKIY, V. I., LYSENKO, I. V., PILIPENKO, G. S.,
and KRAVCHENKO, V. A., Dnepropetrovsk Metallurgical Institute

ON THE PROBLEM OF THE STABILITY OF CONTINUOUS METAL REFINING IN CONTINUOUS
STREAM REACTORS

Moscow IVUZ. CHERNAYA METALLURGIYA in Russian No 7, 1976 pp 51-54 manuscript
received 20 Jun 74

[Abstract] Stable results reflected in a constant chemical composition and temperature of the steel obtained, are essential for apparatuses producing a continuous flow of steel. The components used for continuous steel production are a reactor and a settling tank, in series; more complex assemblies are also found. Features of the reactor of the test assembly were obtained by the method of impulse charging with a liquid copper indicator, using calculated concentrations. The reactor proved to be an ideal mixer. The settling tanks were conceived as reactors providing the ideal displacement, without affecting the nature of the charging impulses. In determining the effects of fluctuations of reagents on chemical stability, it was accepted a priori that iron consumption was a constant, and that minor variations could be ignored; oxygen consumption was carefully
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USSR

PANIOTOV, YU. S., BAPTIZMANSKIY, V. I., LYSENKO, I. V., PILIPENKO, G. S.,
and KRAVCHENKO, V. A., IVUZ. CHERNAYA METALLURGIYA No 7, 1976 pp 51-54

controlled. Results indicated a graduated change in concentration to be the least favorable; for most brands of steel alloyed with carbon, oxygen content varied only in the range of 0.06-0.10%. The test apparatus was capable of producing 6-8 ton/hr with two reactors utilizing a time constant of 250 sec. and an interval of regulation of 60 sec. Variations in reagent consumption should be less than 6.6%. Figures 2; references 3: all
Russian.

2/2

USSR

UDC 669.24:620.186.5

BOKSHTEYN, S. Z., GINZBURG, S. S., TOROSYAN, E. A.

THE EFFECT OF GRAIN BOUNDARY HEREDITY AND PROPERTIES OF RECRYSTALLIZED
NICKEL ALLOYS

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8,
1976 pp 61-63

[Translated from Author Abstracts provided in the Journal]

[Text] A study is made of the stability of the grain boundary heredity effect in recrystallized metal in binary nickel alloys and heat resistant type KHN77TYUR alloy, as well as the influence of the effect on micro-hardness and the diffusion characteristics. It is established that the stability of the effect increases upon alloying, particularly in the case of appearance of a second phase of variable solubility. When there are hereditary boundaries, the diffusion permeability of alloys and micro-hardness of the boundary area increase.

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USSR

UDC 620.186.4:669.14.018.29

BOTVINA, L. R., KOLOKOLOV, YE. I.

REGULARITIES OF DEVELOPMENT OF FATIGUE CRACKS IN THE VISCOUS-BRITTLE
TRANSITION INTERVALS

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8,
1976 pp 45-48

[Translated from Author Abstracts provided in the Journal]

[Text] Based on studies of fractographic peculiarities of fatigue rupture and the fatigue characteristics of certain structural materials, regularities of fatigue rupture in the interval of viscous-brittle conversion are determined. It is shown that the viscous-brittle conversion in the process of fatigue is accompanied by a decrease in the critical crack length, a change in the microrelief of rupture, a decrease in the ratio of the fatigue limit to the ultimate strength and a change in the relationship of the number of cycles required to form a crack to the number of cycles required to make it propagate. A fractographic method is suggested for estimating the brittleness temperature in cyclical loading.

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USSR

UDC 669.15.788-172:620.191.33

ALYMOV, V. T., ALEKSEYEV, S. I., KOZELKIN, V. V., MOZHAYEV, A. V.

VISCOSITY OF RUPTURE OF CRYOGENIC ALLOYS AND ESTIMATION OF THEIR STRUCTURAL STRENGTH

Moscow METALLOVENDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 8, 1976 pp 35-39

[Translated from Author Abstracts provided in the Journal]

[Text] Studies are presented of the viscosity of rupture K_{Ic} of steels 07Kh16N6 and 03Kh12N10MT, aluminum alloys 1201 and 01381 and titanium alloy VT5-1kt at 4.2 and 20°K. Their structural strength, resulting from the presence of crack-type defects, is estimated from the standpoint of the linear mechanics of rupture.

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USSR

ROMANOV, A. V., KURTASOVA, L. A., POLYANSKIY, V. M., and YUVENAL'YEVA, L. N.

APPLICATION OF ELECTRIC-SPARK CUTTING DURING THE MANUFACTURE OF THIN ALUMINUM ALLOY FOILS

Moscow ZAVODSKAYA LABORATORIYA in Russian Vol 42, No 7, 1976 pp 823-824

[Abstract] In order to obtain electron microscope data equally applicable to all Al alloys, 99.99% pure single annealed aluminum crystals were used. Structural changes due to electric-spark cutting were evaluated on the basis of ω - and 2ψ x-ray scanning. In the case of a perfect crystal structure, the width of the line (β^ω) obtained by ω -scanning should be close to that ($\beta^{2\psi}$) obtained by 2ψ -scanning. The depth of deformation produced by the electric-spark cutting of single crystal specimens amounted to 200 μm , i.e., a layer of Al of this thickness must be removed (by electropolishing) before β^ω and $\beta^{2\psi}$ become similar and further polishing did not produce any structural changes. Annealing of specimens at 400°C for 12 hours did not change the β^ω and $\beta^{2\psi}$ values. Figures 1.

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USSR

UDC 669.017.548.4

GABIDULLIN, R. M., KOLACHEV, B. A., KOLPACHEV, A. A., Moscow Aviation Institute

THE METAL-VACANCY STATE DIAGRAM (A DISCUSSION)

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA in Russian No. 4, 1976 pp 87-91 manuscript received 11 Feb 75

[Abstract] It has been shown that vacancies in metal can be looked upon as a component with volume but zero mass. Therefore, the concept of the equilibrium solubility of vacancies has been introduced, corresponding to the maximum concentration for a given temperature and pressure not causing coagulation of vacancies. A natural development of this idea is the concept of the metal-vacancy state diagram. A portion of a hypothetical metal-vacancy state diagram is presented. The far left point on the concentration axis corresponds to metal with no vacancies, the far right point -- to a vacuum. A study is made of the nature of change of placement of phase areas in a metal-vacancy system as temperature and pressure are changed. A vacoeutectoid and vacoperitectoid state diagram is developed. The interpretation of the equilibrium of a metal-vacancy system as a

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USSR

GABIDULLIN, R. M., KOLACHEV, B. A., KOLPACHEV, A. A., IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY, TSVETNAYA METALLURGIYA No. 4, 1976 pp 87-91

state diagram automatically extends the terminology used for the description of ordinary metal systems to it. A future article by the same authors will present practical applications of this interpretation of metal-vacancy equilibrium.

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USSR

UDC 669.295

PUTINA, O. A., PUTIN, A. A., Kholmogorov, S. N. and Tashlykov, Yu. N.

HEATER CORROSION IN TITANIUM SPONGE SEPARATION FURNACES

Moscow TSVETNYYE METALLY in Russian No 5, May 76 p 50

[Abstract] Studies were done to determine the cause of failure of Kh20N80 nichrome heating rods in titanium sponge separating furnaces. Chemical analysis of the film on the rods, the crust on the furnace lining and the gas phase of the furnace showed evidence of chlorination due to leakage of molten magnesium chloride into the furnace. At working temperatures of 1000-1200°C the oxide film on the heaters is attacked by chlorine and hydrogen chloride gas which forms metal chlorides. Sublimation of these chlorides leaves the metal exposed to further attack by oxygen, chlorine and hydrogen chloride along grain boundaries. It is suggested that reliable sealing of equipment to prevent magnesium chloride from reaching the furnace should reduce heater corrosion.

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USSR

UDC 621.318:538.12

ARSIRIY, I. M., KOZLOV, YU. I., Novocherkassk Scientific Research Institute for Permanent Magnets

LOW TEMPERATURE THERMOMAGNETIC WORKING OF PERMANENT MAGNETS IN STATIC AND PULSED MAGNETIC FIELDS

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No 7, 1976 pp 52-53

[Abstract] A study is made of low temperature thermomagnetic treatment in static and pulsed magnetic fields of magnico alloy, alloyed with silicon, niobium, titanium and lanthanum. This treatment of this alloy, which has high resistance to high temperature decomposition, produces high magnetic properties by increasing the intensity of the magnetic field and making its configuration conform more to the magnetic texture of the permanent magnet. The use of low temperature thermomagnetic working of permanent magnets decreases the heating temperature from 1280 to 900°C, thus decreasing the consumption of electric power, increasing the yield of good magnets and assuring an economic effect when it is introduced into production.

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USSR

UDC 669.868:669.018.58:669.721:24'25

KOZLOV, YU. I., DAVYDOVA, R. T., Novocherkassk Scientific Research Institute for Permanent Magnets

INFLUENCE OF YTTERBIUM ON THE PROPERTIES OF MAGNICO ALLOY

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 7, 1976 pp 49-50

[Abstract] A study is made of the influence of ytterbium on the magnetic properties, high-temperature decomposition of the α -solid solution, structure and quantity of nonmetallic inclusions in an alloy containing 23% Co, 13.5% Ni, 7.8% Al, 3% Cu, 0.5% Nb, 0.2% Ti, 0.9% Si; remainder iron. The content of ytterbium varied from 0.1 to 0.9%. The addition of 0.3% Yb to a magnico type alloy with 0.9% Si, 0.5% Nb and 0.2% Ti increases the maximum magnetic energy by up to 24 kJ/m³ and decreases the quantity of harmful impurities, significantly improving the grinding properties of the alloy.

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USSR

UDC 669.788:669.715 721

LEVCHUK, B. V., ANDREYEV, L. A., Moscow Institute of Steels and Alloys

INTERACTION OF Al-Mg ALLOYS WITH HYDROGEN

Moscow METALLOVEDENIYE I TERMICHESKAYA OBRABOTKA METALLOV in Russian No. 7, 1976 pp 23-27

[Abstract] A study is made of the peculiarities of interaction of porous aluminum-magnesium alloys with hydrogen. Hydrogen content was determined by the method of vacuum heating with continuous recording of the quantity of hydrogen liberated from cylindrical specimens 5 mm in diameter and 20 mm long made from blanks after casting and hot pressing. With the distribution of pores thus produced, the gas liberation rate depends in a complex manner on time. However, the experimental data produced agree well with an exponential dependence. This probably corresponds to the case when differences in pore geometry and their orientation relative to the grain boundaries are quite slight.

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USSR

UDC 669.3+669.24:620.192.4

MATYUSHENKO, L. A., SHMATOV, V. T., BERESNEV, B. I., Institute of Metal Physics, Acad. Sci. USSR

CONCENTRATION OF POINT DEFECTS AND DISLOCATION DENSITY IN COPPER AND NICKEL DEFORMED UNDER HIGH PRESSURE

Moscow FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol. 41 No. 6, Jun 76 pp 1290-1297 manuscript received 10 Nov 75

[Abstract] Analysis of the growth of resistivity in copper and nickel after plastic deformation to the same degree by drawing, drawing under pressure and hydraulic extrusion shows that: 1) the maximum number of defects in the material is observed with the last form of working; 2) dislocations are basically responsible for the increase in resistivity observed. The lowest dislocation density is observed in specimens drawn under pressure. Drawing under pressure is the "mildest" form of plastic deformation. The high pressure prevents the development of dislocations, since the growth of their density is accompanied by an increase in volume of the specimen. The elevated density of dislocations after hydraulic extrusion apparently results from the fact that the presence of pressure

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USSR

MATYUSHENKO, L. A., SHMATOV, V. T., BERESNEV, B. I., FIZIKA METALLOV I METALLOVEDENIYE Vol. 41 No. 6, Jun 76 pp 1290-1297

during the course of working by this method is not as effective as the other peculiarities of the deformation method and also, possibly, by the high value and nature of the field of stresses at the deformation focus.

2/2

USSR

UDC 669.35'71+669.245'25:539.434

ARISTOVA, I. M., KUZ'MIN, S. L., LIKHACHEV, V. A., MYSHLYAYEV, M. M.,
OLEVSKIY, S. S., RELINA, N. V., Institute of Solid State Physics, Acad.
Sci. USSR

INFLUENCE OF DEGREE OF SPLITTING OF DISLOCATIONS ON CREEP of Cu-Al and Ni-Co
ALLOYS UNDER CONDITIONS OF TORSION

Moscow FIZIKA METALLOV I METALLOVEDENIYE in Russian Vol. 41 No. 6, Jun 76
pp 1265-1273 manuscript received 16 Sep 75

[Abstract] A study is made of the creep of copper, its alloys with aluminum, nickel and its alloys with cobalt under conditions of torsion. It is shown that the rate of deformation in the stable state follows the ordinary equation of the theory of reaction rates considering the influence of temperature on the structurally sensitive coefficient $v(T)$. The regularities of the development of the dislocation structure in the process of creep are studied by means of an electron microscope. The results indicate that the deformation rate is determined by the intersection of dislocations at the junctions of dislocation boundaries of the blocks. There is therefore reason to believe that the creep in the stable stage is controlled by processes

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USSR

ARISTOVA, I. M., KUZ'MIN, S. L., LIKHACHEV, V. A., MYSHLYAYEV, M. M.,
OLEVSKIY, S. S., RELINA, N. V., FIZIKA METALLOV I METALLOVEDENIYE Vol. 41
No. 6, Jun 76 pp 1265-1273

of intersection of dislocations. This point of view allows a noncontradictory interpretation of all of the main observed facts concerning both the mechanical and structural behavior of the materials studied.

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USSR

UDC 546.623'21:539.238

KORZO, V. F., Moscow Aviation Technology Institute

OPTICAL AND ELECTRIC PROPERTIES OF NONCRYSTALLINE Al_2O_3 FILMS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 12 No. 7, Jul 76

pp 1224-1229 manuscript received 10 Dec 73

[Abstract] A study is made of the optical and electric properties of specimens of Al_2O_3 films with amorphous, ultradispersed and polycrystalline structures. A method is developed for producing films of controlled structural disordering based on activation decomposition of vapors of Al-containing organic compounds in a stream of inert gas. Comparison of the data produced allowed qualitative conclusion of the proposed energetic structure of localized electron states in the films. Based on comparison of the electric, temperature and optical characteristics of the films, a zonal diagram of localized electron states in films of Al_2O_3 with varying degrees of structural disordering is calculated.

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USSR

UDC 546.48-31:542.65

METUSHEVSKIY, A. S., VLASOV, A. S., TIMASHEV, V. V., KUDRYASHOV, V. V.,
D. I. Mendeleyev Institute of Chemical Technology, Moscow

STUDY OF THREAD-LIKE MgO CRYSTALS PRODUCED BY VARIOUS METHODS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol 12, No 7, Jul 76 pp 1215-1218 manuscript received 26 Sep 74

[Abstract] Results are presented from comparison of various methods of growing thread-like MgO crystals, as well as results of investigation of their crystalline quality, dimensions and tensile strength. It is established that the method of growing thread-like crystals by reduction of magnesium oxide with aluminum allows high quality crystals to be produced in relatively large quantities. The strength of the thread-like crystals depends on the crystallographic orientation more than on the method of their production. The method of production basically determines the number of defective crystals.

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USSR

UDC 531

SANDULOV, D. B., SOKOLOVA, A. N., LOKHMATOVA, R. A., Simferopol' State University

MECHANICAL PROPERTIES OF THREAD-LIKE MgO CRYSTALS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 12 No. 7, Jul 76
pp 1315-1317 manuscript received 24 Jul 74

[Abstract] Thread-like MgO crystals were produced by the method of chemical transport reactions in argon. The substrate used was polycrystalline graphite. The temperature in the zone of interaction of MgO with the transporting agent was 1600-1750°C, in the crystallization zone -- 1200-1500°C. The thread-like crystals varied in length from 5 to 200 mm, with a thickness up to a few tenths of 1 μ m. Typical deformation diagrams of the crystals are presented. The form of the curve depends essentially on the direction of growth of the crystal, though flow waves are not seen in any case. The strength of crystals 1-3 μ m in diameter reached 1750 kg/mm².

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USSR

UDC 546.221+546.289:542.3

NIKIFOROV, L. V., NAGIYEV, V. A., GRABCHAK, V. P., Moscow Aviation Technology Institute

DENSITY OF MELTS OF Ge-FeS AND GeS-FeS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 12 No. 7, Jul 76
pp 1183-1186 manuscript received 29 Dec 74

[Abstract] The authors determined the density of the sulfides of Fe and Ge and Ge-FeS and GeS-FeS melts in the solid and liquid states by dilatometric and pycnometric methods respectively. The error in the determination of density in the solid and liquid phases was 0.8 and 0.5% respectively. The coefficients of linear expansion of the sulfides of Fe and Ge are defined. Volumetric changes during melting of Fe and Ge sulfides are estimated. Using the results of the measurement of density, values of melting points of the eutectic are found in the systems Ge-FeS and GeS-FeS.

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USSR

UDC 546.21:54.142

NIKIFOROV, L. V., NAGIYEV, V. A., GRABCHAK, V. P., Moscow Aviation Technology Institute

THE VISCOSITY OF SULFIDE MELTS

Moscow NEORGANICHESKIYE MATERIALY in Russian Vol. 12 No. 7, Jul 76
pp 1179-1182 manuscript received 29 Jul 74

[Abstract] The viscosity of melts of $\text{FeS-Ni}_3\text{S}_2$, $\text{FeS-Cu}_2\text{S}$, $\text{Cu}_2\text{S-Ni}_3\text{S}_2$, FeS-CoS was measured from the melting point to 1250°C using a high temperature vacuum viscosimeter and the formulas for slightly viscous liquids. The relative error in the determination of the temperature dependence of viscosity was 10%. It is established that in the precrystallization period of Ni_3S_2 , the near order structure is restructured, while Cu_2S retains the characteristic features of solid Cu_2S as it melts. The minimum η on the viscosity-composition diagram of the system $\text{Cu}_2\text{S-Ni}_3\text{S}_2$ corresponds to the eutectic concentration and correlates well with the minimum value of activation energy for viscous flow of the eutectic alloy. The values of energy and entropy of activation of viscous flow of the sulfides of Ni, Cu and Co are calculated.

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USSR

UDC 621.791.75:537.523

YEROKHIN, A. A., SALIYEVA, O. G., ROZOV, A. F., OL'SHANSKIY, A. N. and D'YACHENKO, V. V., Moscow

CONCERNING THE INFLUENCE OF EXTERNAL PRESSURE ON THE ABSORPTION OF NITROGEN BY MOLYBDENUM FROM AN ARC PLASMA

Moscow FIZIKA I KIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 136-138 manuscript received 1 Mar 76

[Abstract] Experiments were done to determine the effect of high pressure on nitrogen absorption from an arc plasma by refractory metals with high (niobium) and low (molybdenum) solubility of nitrogen. The metal specimens were placed in a chamber with an argon-nitrogen mixture of known composition on a backing of cast tungsten, and were melted by an arc struck between a tungsten electrode and the specimen. The experiments with niobium showed that the rate of absorption and equilibrium concentration of nitrogen are practically independent of the total pressure in the chamber. An increase of pressure to 8.5 atmospheres while holding the partial pressure of nitrogen constant had no appreciable effect on nitrogen absorption by niobium or by an alloy of molybdenum with 6% zirconium. However, the nitrogen content in the metal can be increased by the appreciable increase in partial pressure that

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USSR

YEROCHKIN, A. A., SALIYEVA, O. G., ROZOV, A. F., OL'SHANSKIY, A. N. and D'YACHENKO, V. V., FIZIKA I KHIMIYA OBRABOTKI MATERIALOV, No 4, Jul/Aug 76, pp 136-138

is possible when the total pressure is raised. In the case of molybdenum, a suppression of nitrogen porosity was observed at a pressure of 10.5 atmospheres with some reduction of the maximum nitrogen content. References 2 Russian.

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USSR

UDC 535.211

UGLOV, A. A., OREKHOV, M. V. and KOKORA, A. N., Moscow

IMPROVING THE EFFECTIVENESS OF LASER MACHINING

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 135-136 manuscript received 28 Oct 74

[Abstract] The paper describes a mechanical modulator used to improve the effectiveness of laser machining. The modulator was a perforated opaque disk rotated by an electric motor. Holes about 7 mm in diameter were spaced 14 mm apart around the edge. The disk was placed in a spherical optical resonator with an active element of neodymium glass. The speed of rotation ranged from 12,000 to 16,000 rpm. Despite some loss of energy, it was found that the use of such a modulator makes it possible to machine deeper holes. Another advantage of the mechanical modulator is that longer pumping pulses extend the life of the flash lamp. Also, since several laser pulses are produced for each flash of the pumping lamp, more holes can be machined during the service life of the lamp. References 6 Russian.

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USSR

UDC 666.76

GAL', V. V., ZALESSKAYA, I. M., IVANOV, A. B., KRASULIN, YU. L., BORODINA, T. I., and MNUSHKIN, L. D., Moscow

ON THE MORPHOLOGICAL PARTICULARS AND STRUCTURE OF ALUMINUM OXIDE MICROSPHERES

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 127-130 manuscript received 11 Feb 76

[Russian abstract provided by the source]

[Text] The paper gives the results of an investigation of the structure of microspheres of aluminum oxide made by plasma treatment of white electrocorundum powder in a high-frequency discharge. It was established by optical and electron microscope studies that a dendritic structure is formed in the surface layer of the microspheres under conditions of sharp supercooling. An analysis is made of the peculiarities of crystallization of aluminum oxide microspheres as they are being formed. References 4 Russian.

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USSR

UDC 539.4

ASONOV, A. N., BARINOV, S. M., ZALESSKAYA, I. M., IVANOV, A. B., KRASULIN, YU. L., TIMOFEYEV, V. N. and SHNYREV, G. D., Moscow

INVESTIGATION OF THE STRENGTH OF MICROSPHERES OF STABILIZED ZIRCONIUM DIOXIDE

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 123-126 manuscript received 10 Dec 75

[Russian abstract provided by the source]

[Text] An investigation is made of the compression strength of microspheres of stabilized zirconium dioxide (250-315 μm) made by rf-discharge plasma treatment. It is found that additional annealing of the microspheres improves their structural uniformity, and thus increases strength. With thermal cycling, softening of annealed spheres takes place with greater intensity than in the microspheres immediately after plasma treatment. Maximum tensile stresses of the microspheres are calculated in the approximation of solution of the Hertz problem on approaching balls by the method of successive approximations. It is shown that the microspheres are adequate in strength for use in making construction materials. References 6: 2 Russian, 4 Western.

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USSR

UDC 669.018:539.377

SAVITSKIY, YE. M., YEFIMOV, YU. V., and ZVOLINSKIY, O. I., Moscow

DUCTILITY OF VANADIUM-GALLIUM-COPPER ALLOYS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 79-83 manuscript received 11 Mar 76

[Abstract] An investigation was made of the influence that copper has on the ductility properties of V_3Ga intermetallic compound. The copper content was varied from 0 to 50 at.%. Tests were done on the UME-10TM ram jolting machine at a constant strain rate of 0.07 s^{-1} for all specimens. The tests were done at temperatures of 25, 400, 500, 600, 700 and 800°C . It was found that increasing the copper content in the ternary system improves deformability at high temperatures. The fracture of the alloys changes from brittle to viscous with an increase in copper content and temperature. References 8: 4 Russian, 4 Western.

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USSR

UDC 537.523.5

BABAL'YANTS, V. F., VURZEL', F. B., NAZAROV, V. F. and KHODOROV, F. S.,
Moscow

PLASMA CUTTING OF MATERIALS WITH HIGH-VISCOSITY MELTS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 62-69 manuscript received 20 Oct 75

[Russian abstract provided by the source]

[Text] A mathematical model is developed that describes plasma cutting of materials with melts of high viscosity, including an equation for heat propagation in the material, an equation of relaxation of the structure (viscosity) and an equation of motion of the layer being melted. For flat plate glass and quartz glass the authors determine the way that cutting speed depends on the dynamic head of the plasma jet, the heat flux to the wall, and the thickness. Experimental studies are done on plasma cutting of glass. Conditions are found for producing a high-quality cut. Cutting speeds agree satisfactorily with theoretical data. References 10 Russian.

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USSR

UDC 539.4.019:621.791.011

ATAMANOVA, G. N., MEL'KER, A. I. and TOKMAKOV, I. L., Leningrad

DESTRUCTION OF ALUMINUM ALLOY BY PULSED ELECTRON BEAMS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 29-32 manuscript received 15 Apr 75

[Abstract] An x-ray study was done on residual stresses and changes in the fine structure of aluminum that arise as a result of pulsed bombardment by electrons. The studies were done on specimens of D16 alloy plated with aluminum on both sides. The specimens were 2 mm thick, and each layer of aluminum was 0.15 mm thick. An electron beam from the REP-5 accelerator was trained on the surface in the normal direction. The specimen was supported on the reverse side by lead backing. Particle distribution was close to normal (Rayleigh), and electron flux density was of the order of $10^{23} \text{ cm}^{-2} \cdot \text{s}^{-1}$, about 50% of the particles having an energy of 1.65 MeV. Pulse duration was 20-30 ns, and the spot diameter on the surface of the specimen was about 15-20 mm. The M-220 digital computer was used for harmonic analysis of the shape of the diffraction lines and determination of the characteristics of the fine structure. It was found that as the number of pulses increases, there is a change in the level of stresses in the

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USSR

ATAMANOVA, G. N., MEL'KER, A. I. and TOKMAKOV, I. L., FIZIKA I KHIMIYA OBRABOTKI MATERIALOV, No 4, Jul/Aug 76 pp 29-32

surface layers of aluminum specimens exposed to relativistic electrons, and the curve for residual stresses of the first kind changes sign at the instant of peeling. A model is suggested for destruction of irradiated specimens in which destruction occurs after a critical degree of disintegration is reached with a fairly high level of internal microstresses (stresses of the second kind) under the action of shock waves. References 14: 9 Russian, 5 Western.

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USSR

UDC 535.241.4

KRISHTAL, M. A., ZAKHAROV, P. N. and KOKORA, A. N., Togliatti, Tula, Moscow

ON THE CONTRIBUTION OF DIFFUSION PROCESSES TO THE REDISTRIBUTION OF MATTER
IN A SOLID UNDER THE ACTION OF LASER EMISSION

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 24-28 manuscript received 13 May 74

[Abstract] An investigation is made of the part played by diffusion processes (thermal diffusion, diffusion under pressure and with plastic deformation) on the redistribution of impurity elements in the solid phase under the action of laser emission. The analysis is based on simplified physical models. The results show that thermal diffusion could not possibly result in the redistribution of matter experimentally observed in the zone of laser action, even when plastic deformation is accounted for. The main contributors are the following nondiffusive mechanisms: depletion or enrichment of a narrow layer of molten metal in the zone of laser action with alloying elements due to differences in vapor pressure between these elements and the base metal; a body vapor-forming effect that increases the fraction of vaporized elements in bubbles formed in the zone of laser action; enhanced penetration of carbon atoms from the atmosphere. References 11: 10 Russian, 1 Western.

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USSR

UDC 621.791:537.523

BALATSKIY, A. A., UGLOV, A. A., LOBACHEVA, G. YA and KAYRO, D. P., Moscow

ON ESTIMATING THE EFFECTIVENESS OF LASER EMISSION WHEN MELTING MATERIALS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 13-17 manuscript received 3 Jan 75

[Abstract] An examination is made of questions relating to evaluation of the effectiveness of laser emission and analysis of factors that influence the parameters of the resulting melting in metal. It is shown that when screening is taken into account the effective efficiency of metal heating by laser emission is $\eta = R - (k_1 + k_2)$, where R is a coefficient showing the fraction of energy absorbed by the metal, k_1 is a coefficient showing the fraction of energy transmitted to the metal through the layer of removal products, and k_2 is a coefficient that includes energy losses to radiation, stimulation of convection, surface deformation, etc. Estimates show that when the thermal equivalent of laser emission power is around 10^6 W/cm², k_2 is no more than 5-7%, so that finding η involves the determination of k_1 . Experiments are described in which R and k_1 are determined by exposing a rotating disk to laser emission. The results show that under certain conditions the heating process is accompanied by splashout. References 3 Russian.

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USSR

UDC 535.211

BARANOV, M. S., VERSHOK, B. A., and GEYNRIKHS. I. N., Moscow

INFLUENCE OF LASER EMISSION INTENSITY ON THE MECHANISM OF CRATER DEEPENING
IN METALS

Moscow FIZIKA I KHIMIYA OBRABOTKI MATERIALOV in Russian No 4, Jul/Aug 76
pp 8-12 manuscript received 13 Jan 76

[Russian abstract provided by the source]

[Text] A detailed theoretical study is made of the process of deepening of the crater formed in metals by laser emission. If developed vaporization takes place during the greater part of the pulse, then the rate of deepening at comparatively low emission intensities q is determined by the process of displacement of the liquid phase from the bottom of the crater, while at fairly large q the decisive factor is vaporization of the bottom. Expressions are found for the values of q that limit the given regions. References 7 Russian.

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USSR

UDC 536.12

BENDELIANI, N. A., ORLOV, M. R., Institute of High Pressure Physics, Acad. Sci. USSR

THE SYSTEM $\text{CaF}_2\text{-ScF}_3$ AT A PRESSURE OF 100 Kbar AND A TEMPERATURE OF 1200°C

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 229, No 5, 1976 pp 1098-1100 manuscript received 9 Feb 76

[Abstract] This work is a continuation of studies of the polymorphism of scandium trifluoride under the influence of high pressures and temperatures. Data are produced on the phase relationships in the system. The result of annealing the tiesonite-like modification in a vacuum for four hours was somewhat unexpected. Complete dissolution of the solid solution at 500°C into individual components is preceded by an intermediate state with an $\alpha\text{-UO}_3$ -type state, stable in the 300-400°C interval. The parameters of the hexagonal lattice for the composition $\text{Sc}_{0.85}\text{Ca}_{0.15}\text{F}_{2.85}$ are: $a = 3.87\text{\AA}$, $c = 4.08\text{\AA}$, $c/a = 1.05$. The most important changes in the phase diagram known at normal pressures consist in the appearance of an area of tiesonite-like solid state near pure ScF_3 and a significant increase (by a factor of approximately 5) of the concentration interval of stability of the CaF_2 -based on solid solution.

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USSR

UDC: 621.771.6

TRISHEVSKIY, I. S., Professor, Doctor of Technical Sciences, and DOKTOROV, M. Ye., Candidate of Technical Sciences, Ukrainian Scientific Research Institute of Metals

A NEW TECHNIQUE FOR MAKING CURVED PROFILES BY USING TEMPORARY FLEXURE OF FLAT SECTIONS

Moscow STAL' in Russian No 8, Aug 76 pp 719-723

[Russian abstract provided by the source]

[Text] An examination is made of basic schemes for shaping curved profiles with the use of temporary curvature of flat sections (with subsequent straightening) to create transverse compression or tension on the metal at points of bending so as to prevent thinning and improve the quality of the structural shape. New schemes have been proposed at the Ukrainian Scientific Research Institute of Metals for making half-open, corrugated structural shapes, using low-ductility metals, etc. Graphs are plotted for calculating the main technological parameters of profiling. References 7 Russian.

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USSR

UDC 669.743.1/2

SUCHKOV, A. B., KRYZHOVA, V. N., VOROB'YEVA, A. S. and LYAKHIN, B. P., Central Scientific Research Institute of Ferrous Metallurgy

PRODUCTION OF MANGANESE FROM LEAN MANGANESE ORES BY ELECTROLYSIS IN MOLTEN MEDIA

Moscow STAL' in Russian No 8, Aug 76 pp 714-715

[Russian abstract provided by the source]

[Text] A technique for producing commercially pure metallic manganese from lean manganese ores by electrorefining prerduced ores of the Chiatura deposit or their concentrates in molten salts has been developed under laboratory conditions, and has undergone experimental industrial testing at the Zestafoni Plant of Ferroalloys and at the "Tulachermet" Scientific Production Association. The proposed method does not require dumping of waste water, and no gases are emitted into the atmosphere. Assuming continuous 74% extraction of manganese on both stages and expenditure of electric energy of about 5000 kW per hour per metric ton, the cost of the finished manganese should be lower than for production by currently used methods. The anode slurry contains phosphorus, silicon and carbon. References 3 Russian.

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USSR

UDC 669.721'793'794:621.78

DRITS, M. YE., ROKHLIN, L. L., NIKITINA, N. I., Moscow

PHASE EQUILIBRIA IN MAGNESIUM RICH Mg-Y-Sc ALLOYS

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 4, Jul-Aug 76
pp 217-221 manuscript received 18 Jun 75

[Abstract] A study was made of phase equilibria in Mg-Y-Sc alloys containing up to 22% yttrium and up to 27% scandium. This range of concentration covers alloys of practical interest, i.e., those alloys with high strength properties at room temperature and up to 350°C. In the Mg-Y system it was found that there is the $Mg_{24}Y_5$ phase in equilibrium with a magnesium-base solid solution, and that a β -phase and γ -phase are formed in binary Mg-Sc alloys. Joint solubility of yttrium and scandium in a magnesium-base solid solution decreases with decreasing temperature. Yttrium and scandium decrease each other's solubility in a magnesium solid solution. A four-phase, nonvariant peritectic transformation $Zh + \beta \rightarrow \alpha + Mg_{24}Y_5$ takes place in the magnesium corner of the Mg-Y-Sc system. Figures 3; references 12: 8 Russian, 4 Western.

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USSR

UDC 669.295-620.183.548

BELOUSOV, O. K., Moscow

AXIAL RATIOS AND ELECTRONIC STRUCTURE OF TITANIUM ALLOYS WITH HEXAGONAL STRUCTURE

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 4, Jul-Aug 76 pp 190-196 manuscript received 28 Apr 73

[Abstract] The interaction between the Fermi surface and Brillouin zone planes affects the forces which expand and compress the lattice of hexagonal crystals of metals and alloys and determines the axial ratio. The results of measurements of the periods of α -lattice in titanium alloyed with gallium, indium and germanium were compared with c/a axial ratios of some binary titanium alloys. It was found that alloying of titanium with nontransition elements leads to an increased c/a ratio in the alloys. It was also shown that alloying of titanium with transition metals (except zirconium) in small quantities leads to the stability loss of α -structure due to a rapid increase of kinetic energy of electrons and to the maximum values of n_z . Figures 4; references 17: 8 Russian, 9 Western.

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USSR

UDC 621.771

ASTROV, YE. I., NIKOLAYEV, A. N., SHOTKIN, YU. A., Gor'kiy

FORMATION OF CONTACT ZONE STRUCTURE IN HOT ROLLING OF MULTILAYER METALS AND METAL POWDERS

Moscow IZVESTIYA AKADEMII NAUK SSSR, METALLY in Russian No 4, Jul-Aug 76
pp 93-96 manuscript received 26 Mar 75

[Abstract] The effect of hot rolling and subsequent annealing on the structure of the contact zone of multilayer metals and metal powders was studied. Specimens of the following metals were hot rolled in an atmosphere of hydrogen: 08kp steel, M1 copper, NPl nickel, Kh18N9T stainless steel, industrial iron powder, PZhM iron powder, PNK carbonyl nickel powder, PM1 electrolytic copper powder, and Kh18N9T stainless steel powder. The rolling temperatures were 800 and 1200°C for 08kp steel and iron powder, 950°C for copper and copper powder, 1200°C for nickel and nickel powder, and 1200°C for stainless steel. It was found that the boundaries between individual layers are preserved in the process of primary recrystallization in hot rolling of multilayer metals which do not undergo polymorphous transformation. If the polymorphous transformation followed the primary recrystallization it led to a complete recrystallization and there were no boundaries noticed
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USSR

ASTROV, YE. I., NIKOLAYEV, A. N., SHOTKIN, YU. A., IZVESTIYA AKADEMII NAUK SSSR, METALLY No 4, Jul-Aug 76 pp 93-96

between the layers. In hot rolling of unsintered powder metals, boundaries between the initial powder particles are obliterated also in metals which do not undergo polymorphous transformation when the specimens reach a relative density of about 90% or higher. Figures 4; references 6: all Russian.

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CSO: 1842

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